EAST INDIAN RAILWAY.

MANUAL OF RULES

FOR

Guidance of the Engineering Department

IN ADDITION TO

The General Rules for all Open Lines of Indian State Railways.

CALCUTTA.
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EAST INDIAN RAILWAY.

Manual for Engineering Department.

Addenda and Corrigenda Slip No. 5.

I. Addenda—

(1) Page 72, para. 236—Before the words "Creosoted Douglas Fir" *interpose* "Deodar" and *after* "Douglas Fir" *add* "and other treated soft wood sleepers."

(2) „ 105, „ 370—The formula noted below to be added—

$$L=\sqrt{S^{2}+4\,R.\,D-D^{2}}$$

II. Corrigenda—

(1) Page 3, para. 15—In the last line the words "or Engineer-in-Charge" should be omitted.

(2) „ 18, „ 66—In the penultimate line of this para. the word "Eyes" should be "District Engineer's."

(3) „ 58, „ 212(a)—*Omit* "1 Doz. metal brushes."

(4) „ 71, „ 234(2)—The word "half" in the penultimate line of this clause should be omitted.

(5) „ 77, „ 262—In supersession of the previous corrigendum this para should read as follows—

"A ½ or $\frac{9}{16}$ inch diameter auger is to be used for boring holes for Deodar sleepers and ⅜ in. auger for soft wood sleepers, for ⅝ in. square Dog spikes."

(6) „ 98, „ 337—The word "Experiment" in the margin should be "Expansion."

(7) „ 106, „ 373A—In the second line of para. 2 of the addendum previously issued the word "caps" should be corrected to "capes".

(8) „ 119, „ 441—In the last line the figure "449" should be "447."

(9) „ 121, „ 443—In the first line the figures "443" and "444" should be "441" and "442" respectively.

(10) „ 121, „ 445—In the last line the figure "445" should be "443."

(11) „ 121, „ 447—In the third line the figures "443" and "444" should be "441" and "442" respectively.

CHIEF ENGINEER'S OFFICE,
Calcutta, 5th December 1928.

J. E. MONK,
[illegible]

It must be clearly understood that this manual does not supersede nor alter in any way the rules contained in the State Railway Codes nor the General rules for open lines Indian State Railways nor Subsidiary Rules in force on the East Indian Railway.

It contains no reference to signalling and Interlocking as the intention is to issue a separate Manual on the subject.

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W. O. No. 632—1,500—28-6-29.

Preliminary.

Every Officer and Inspector of the Engineering Department should have in his possession a copy of the following:—

- Schedule of Maximum, Minimum and Recommended Dimensions.
- Manual for the Guidance of the Engineering Department.
- East Indian Railway Working Time Table with Appendix.
- Telegraph Code Book.
- Coles' Notes on Permanent Way Materials (Engineers and Permanent Way Inspectors.)

All Engineers Offices should have a copy of the following for reference and Inspectors should have such as are considered necessary:—

- State Railways—General Rules for Open Line.
- State Railway Open Line Code Vols. I. and II.
- State Railway Construction Code.
- State Railway Code for Engineering Department 1921.
- Civil Service Regulations.
- Civil Account Code.
- Fundamental Rules and Supplementary Rules.
- State Railway Provident Fund and Gratuity Rules.
- East Indian Railway—Hand Book of General Rules and Regulations of all Departments.
- Land Acquisition Act I of 1894.
- Bengal Land Acquisition Manual.
- Collier's Bengal Municipal Manual.
- Bihar and Orissa Municipal Act.
- United Province Municipal Act.
- Bengal Local Self Government Act, 1885.
- Bengal Village Self Government Act, 1919.
- Indian Factories Act, 1911 and Amendment of 1922.
- Indian Workmen's Compensation Act, 1923.
- Code of instructions for the guidance of Public Works Officers in the erection and testing of lightning conductors
- Rules for storage of petroleum and dangerous spirits.
- Rules governing Churches and Cemeteries.
- Molesworth's Pocket Book of Engineering Formulæ.
- Chief Engineer's circulars.

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CHAPTER I.

GENERAL RULES RELATING TO THE CONDUCT OF ALL RAILWAY SERVANTS.

1. The Indian Railways Act IX of 1890 as amended by Act IX of 1896 defines a "Railway Servant" as any person employed by a Railway Administration in connection with the service of a Railway.

2. All servants holding situations of trust are liable to be required to give security for their faithful service in accordance with the rules of the Railway.

Note.—Under this rule menials receiving salaries of not less than Rs. 15 per mensem are required to execute agreements. The Administration may however in any case in which it is thought desirable require the execution of agreements by menials drawing a salary less than Rs. 15 per month.

3. Applicants in India for employment in an officer or subordinate grade are to undergo a strict medical examination prior to engagement Medical certificates for employment will not be accepted unless signed by one of the Medical Officers appointed by the Administration.

Applicants will at the same time, if required to do so, have to pass an examination for eye sight.

Every servant whose duties necessitate his knowledge of or dealing with signals must have his vision tested and re-tested periodically by a Medical Officer of the Administration.

An employé belonging to the clerical staff, if required to work on the line, or in charge of trains, must undergo the above test before commencing his new duties.

4. Every Railway servant shall, before leaving the service, give the Railway Administration the notice specified in his agreement (if any) or if no notice is so specified, then one month's notice in writing.

4 A. "When a railway servant leaves the service he must deliver up to the Railway Administration or to a person appointed by the Railway Administration in this behalf, any property in his custody which belongs to the Railway Administration."

5. All employés of the Railway are strictly forbidden to employ any of the staff on private work either during or after the usual hours of duty.

6. All servants of the Railway must devote themselves exclusively to its service, and must not engage in any trade or business, either directly or indirectly (see Section 137 Indian Railways Act IX of 1890)

Section 168 of the Indian Penal Code:—

> "Whoever, being a public servant, and being legally bound as such public servant not to engage in trade, engages in trade, shall be punished with simple imprisonment for a term which may extend to one year, or with fine or with both."

7. Before a Railway employé can be handed over to the Police for arrest for a breach of Railway regulations, the responsible officer should in all possible cases obtain, by wire or otherwise, the approval of the Head of the Department or Divisional Superintendent concerned.

8. Railway servants absent from duty without leave, or without medical certificate from the authorized Medical Officer or his Assistants, or from illness caused by their own indiscretion, will render themselves liable to dismissal or fine.

9. Railway servants posted at stations where there is no Railway Medical Officer or Chaplain may in cases of illness make application for medical or spiritual aid or for sick leave by telegraph, free of charge. In the event of a servant becoming incapacitated for duty through sudden illness a report must at once be made of the fact to his superior officer.

10. The possession of a medical certificate does not entitle an employé to quit the station at which he is employed without the special permission of the Medical Officer granting the certificate. An employé who when sick and under treatment quits his station without such permission renders himself liable to summary dismissal.

11. Any employé of the Administration in whose family any contagious or infectious diseases occur must at once report the fact to the nearest Medical Officer of the Administration, who will, after due enquiry, give him a certificate in the authorized form. He must also go off duty until given a certificate by the Administration's Medical Officer permitting him to resume duty.

1. The contagious and infectious diseases referred to in the above paragraph are Plague, Small-Pox, Cholera, Diptheria, Scarlatina, Typhus and Chicken-Pox.

2. An employé put off duty under the operation of this rule shall not quit the station at which he is employed without permission nor be allowed to mix with the residents or attend reading-rooms or public entertainments, or places of worship, during the time he is off duty.

3. (*a*). All clerical and subordinate establishment kept away from work under certificates from the Administration's Medical Officers on this account may be allowed full pay. The period of absence under quarantine will not affect any casual or other leave that may have been earned.

(*b*). These rules also apply in the case of menials of all departments who are monthly paid servants and are not to be affected when substitutes are engaged to carry on the duties of absentees, the cost of any substitute being treated as additional.

(*c*). Half pay only will be granted to all menials who are daily paid servants when they are placed under quarantine and go into segregation camps.

4. In connection with cases of small-pox in the families of employés, when it is found that vaccination has not been taken advantage of, men put off duty on this account will not be allowed the privilege of being granted pay under clause 3 (*a*).

5. This rule will be held to apply to the whole of their families with the exception of children under 3 months' old.

12. Intemperate habits are a disqualification for Railway service and a man known to be intemperate, whether on or off duty, is liable to dismissal for that cause alone.

13. Whenever an employé is judicially convicted of any offence a copy of the decision should be sent to the Head of the Department or Division in which he is employed in order that such action as may be deemed proper may at once be taken in the case.

14. Subordinate Officers, Inspectors, clerks and others are strictly forbidden to grant testimonials or certificates of character or ability to their subordinates.

15. No certificate is to be given to any Railway Servant while he is in the service of the Railway. All certificates given to any class of subordinate on his leaving the service of the Railway for any cause must be approved and countersigned by the Chief Engineer or Divisional Superintendent, ~~or Engineer in charge~~.

16. Certificate of employees who resign or leave the service before completing one year service without fault need not be countersigned. The signature of an officer of the rank of Executive Engineer is sufficient.

17. Railway Servants having reason to walk along the line are warned to walk clear of the rails unless required to do otherwise in the execution of their duty. On the double line, if walking on the cess, they should always walk on the right so as to face trains approaching on the adjacent track.

CHAPTER II.

RESPONSIBILITY OF ENGINEERS AND INSPECTORS FOR SAFE EXECUTION OF WORKS.

18. The attention of all Engineers is called to the obligation that rests on them to consider carefully the methods to be adopted in carrying out works committed to their charge and to give all directions required to ensure that the works are carried out in a safe and workmanlike way.

19. The Engineer in charge or Superintendent, Way and Works, is not relieved from any part of this obligation by the fact that he may have an Assistant Engineer in more immediate charge of supervision nor is the Assistant Engineer any the less responsible for work being properly done when he has an experienced subordinate watching the work. Nor on the other hand is the subordinate less responsible because he has officers over him who are also responsible.

If anything goes wrong each man who might have prevented it by timely warning or directions is to blame for his neglect to prevent it.

It is impossible to lay down precise rules for the guidance of Engineers in carrying into effect these principles. Obviously there is a limit to the amount of personal attention which a District Engineer or Superintendent, Way and Works, can give to the details of a particular work, in the necessity he is under of attending to many other equally important duties, and the same thing applies in a measure to local Engineers. But where works are to be carried out in which mistakes in execution will involve possible danger to life or property, Engineers should prefer to err on the side of being too full and explicit in their instructions rather than on the other side and in all matters of importance should put their instructions in writing.

20. Where drawings are issued from the Chief Engineer's office the Engineer in charge or Superintendent, Way and Works, is expected to study and to understand them and not to be satisfied with passing them on to his assistant for execution. He should add any orders which he thinks are required to ensure the work being properly executed.

If he has any reason to suppose that any matters have been overlooked or misunderstood in preparing plans or instructions it is his duty to represent his views to the Chief Engineer.

The absence of instructions or orders is not a plea which can be used in any case. If they are wanted they can be asked for.

CHAPTER III.

HANDING OVER CHARGE.

21. As cases have occurred of Engineers having proceeded on leave or transfer without leaving proper notes for the guidance of their successors and leaving contractors' claims, etc., unadjusted the following rules are laid down for compliance :—

(*a*) The Engineer to be relieved will give the Relieving Engineer a complete note shewing the boundaries of the charge which is being handed over, the disposition of the staff, the description and condition of the permanent way, the behaviour of any large rivers within this area with information about floods, breaches and so forth. He will give a complete list of all works in hand and the orders remaining to be complied with and of such matters as most require attention, with full explanation of any peculiarity of circumstances or apprehended difficulties. He will also give the Relieving Engineer a brief outline of any matters of general or particular interest that are at present engaging his attention or are peculiar to the Division. A copy of the list and memorandum shall be sent to the Chief Engineer.

(*b*) He will also furnish the Relieving Engineer with a complete statement of all unadjusted claims with the reasons for their not having been adjusted in due course and a report as to any complication likely to arise owing to their non-adjustment. This statement should be accompanied by a " No claim " Certificate in the annexed form from each contractor working under him. In the event of there being claims outstanding the particulars of such claims should be fully entered. In either case the form should be clearly signed by the contractor with his thumb impression if necessary and should be witnessed by two witnesses of whom one at least should be an independent party. It should be particularly noted that no space should be left on the body of the document for other claims to be surreptitiously and possibly fraudulently entered after the document has been signed and witnessed. The Relieved Engineer should sign each document to guard against substitution.

(*c*) When the above have been complied with and the Relieving Engineer shall have visited such out-stations and works as he shall consider necessary the Relieving Engineer will report to his Superior

Officer that the transfer has been completed. He will take the opportunity of bringing to notice anything irregular or objectionable in the conduct of business in the charge which he is taking over that may have come officially under his notice.

(*d*) An Engineer who fails to bring to notice within a reasonable period any deficiency or defect in work or stores taken over from his predecessor will be held responsible for the same, both as to quantity and quality, so far as it may have been practicable for him to ascertain.

(*e*) In case of disagreement between the Relieved and Relieving Engineer a reference is to be made to their Superior Officer.

The same procedure should be adopted in the case of Inspectors.

22. When an Engineer or a Subordinate is transferred from one station to another the latter station shall not be considered his head-quarters until he has formally taken over charge.

Contractor ***Rambuksh***,

Address *Kalipokur Lane, Asansol,*

Working under *Babu J N. Mukerjee, Ondal.* (*a*)

I *Rambuksh,* (*b*) do hereby declare that I have no claim against the East Indian Railway Administration for works done by me on the *Rajbundh* section under *Mr. P. M. Christie.* (*c*) *Sub-Divisional Engineer, Ondal* (*d*) with the exception of the following *three* (*e*) items which are still in progress or under dispute:—

Item.	W. O. No.	D. E.'s No.	Date.	Name of work.	Progress of work.	REMARKS.
1	*37*	*516*	*16th October 1925.*	*Cess repairs*	*Completed*	
2	*51*	*650*	*11th November 1925.*	*Painting bridge 327*	*Completed*	
3	*53*	*675*	*11th December 1925.*	*Building 3 units menials quarters Panagar.*	*In hand*	
4						
5						
6						

(a) Name of Inspector to be given and head quarters.
(b) Name of Contractor.
(c) Name of Engineer.
(d) Head-quarters of Engineer.
(e) Number of items to be specified.

Signature of Witness. *Signature of Contractor.*

Signature of Witness. *Signature of Relieved Engineer.*

NOTE.—Anything unnecessary in this form may be deleted and such alterations should be initialled by the Contractor and Relieved Engineer.

نام کنٹراکٹر کا رام بخش
پتہ کالی پوکھر لین آسنسول

جنکے زیر حکومت کام ہوا اونکا نام اور پتہ بابو جے این مکرجی انڈال (الف) میں رام بخش (ب) بذریعہ اسکے اقرار کرتا ہوں کہ ایسٹ انڈین ریلوے پر میرا کوئی دعوی نہیں ہے اوس کام کے لئے جو راج بندھ سیکشن میں مدت دریعہ مسٹر پی. ایم. کرسٹنگ (ج) سب ڈویژنل انجینیر انڈال (د) ہوا نیچے لکھے ہوے آئین کام (ہ) جو ابھی ہو رہا ہے یا جسکا فیصلہ ابھی تک نہیں ہوا ہے

نمبر	ورک آڈر نمبر	ڈسٹرکٹ انجینیر کا نمبر	تاریخ	کام کا نام	کہاں تک کام ہوا	کیفیت
۱	۳۷	۵۱۶	۱۶ اکتوبر سنہ ۱۹۲۵ع	کم پار کا مرمت	ختم ہوگیا	
۲	۵۱	۶۵۰	۵ نومبر سنہ ۱۹۲۵ع	۳۰۷ نمبر پل کی رنگ سازی	ختم ہوگیا	
۳	۵۳	۶۷۵	۱۱ دسمبر سنہ ۱۹۲۵ع	پانا گڑھ میں نوکروں کے لئے تین مکان کا بنانا	ہورہا ہے	
۴						
۵						
۶						

(الف) انسپکٹر کا نام اور اونکا ہیڈ کوارٹر
(ب) نام کنٹراکٹر کا
(ج) نام انجینیر کا
(د) انجینیر کا ہیڈ کوارٹر
(ہ) کام کا تعداد لکھہ دینا چاہئے

دستخط گواہ کا ______ کنٹراکٹر کا دستخط ______

دستخط گواہ کا ______ دستخط اوس انجینیر کا جو کام سے فارغ ہوے ______

اس فارم میں جسکی ضرورت نہیں ہے اوسکو کاٹ دے سکتے ہیں اور اوس پر کنٹراکٹر اور ریلیوڈ انجینیر کی دستخط ہونا چاہئے

नाम कन्ट्राकटर का रामबक्स ।

पता कालीपाहार लेन आसनसोल ।

जिसके मातहत काम हुआ उनका नाम और पता बाबू जी: एन: मुखरजी अण्डाल (क)

मैं रामबक्स (ख) बजरिये इसके एकरार करता हुं कि ईस्ट इण्डियन रेलवे पर मेरा कोइ दावी नहीं है उस काम के लिये जो रानीगन्ज डिविजन में मेरे जरिया मिस्टर पी: एम: ब्रिस्टोल (ग) एक डिविजनल इञ्जिनियार अण्डाल (घ) हुआ निचे लिखे हुये तिन काम (च) जो अभी हो रहा है या जिसका फैसला अभी तक नहीं हुआ है ।

नम्बर	वर्क आडर नं	डिस्ट्रिक्ट इञ्जिनियर का नं	तारिख	काम का नाम	कहां तक काम हुआ ।	कैफियत ।
१	२७	५१६	१६ अकटुबर सन १९२५ इ:	तार का मरम्मत ।	खतम होगया ।	
२	५१	६५०	५ नवम्बर सन १९२५ इ:	२१७ नम्बर पुल को रंग साजी ।	ऐजन	
३	५२	६७५	११ डिसम्बर सन १९२५ इ	पानागढ़ में नोकरों के लिये तीन मकान का बनाना ।	हो रहा है	
४						
५						
६						

(क) इन्सपेकटर का नाम और उनके हेड कोआटर ।

(ख) कन्ट्राकटर का नाम ।

(ग) इञ्जिनियर का नाम ।

(घ) इञ्जिनियर का हेड कोआटर ।

(च) काम का तायदाद लिख देना चाहिये ।

गवाह का दस्तखत____________ कन्ट्राकटर का दस्तखत____________

गवाह का दस्तखत____________ दस्तखत उस इञ्जिनियर का जो काम से वाकिफ हुये____________

इस फारम में जिसकी जरुरत नहीं है उसको काटदे सक्ते हैं और उस पर कन्ट्राकटर और रेसीडेन्ट इञ्जिनियर की दस्तखत होना चाहिये ।

কণ্ট্রাক্টরের নাম রামবক্স।

ঠিকানা কালীপুকুর লেন, আসনসোল।

যাঁহার অধিনে কার্য্য হইবে তাঁহার নাম ও ঠিকানা বাবু জে. এন. মুখার্জি, অণ্ডাল (ক)।

আমি রামবক্স (খ) এতদ্দারা স্বীকার করিতেছি যে ইহা ব্যতিত রাজবন্দ সেকসানে অণ্ডালের (ঘ) সব—ডিভিজনল ইঞ্জিনিয়ার মিষ্টার পী. এম. রুষ্টীকের (গ) অধীনে যে সকল কার্য্য আমি সমাধা করিয়াছি তাহার জন্য ইষ্ট ইণ্ডিয়ান রেলওয়ের কর্ত্তৃপক্ষের বিরুদ্ধে আমার কোন দাবী রহিল না, যে নিম্ন লিখিত তিনী (চ) দফা কার্য্য যাহা এখনও হইতেছে বা যাহার এ বাবৎ কোন মিমাংসা হয় নাই :—

দফা	ওয়ার্ক অর্ডার নং	ডিষ্ট্রীক্ট ইঞ্জিনিয়রের নং	তারিখ	কার্য্যের নাম	কার্য্য কত পর্য্যন্ত হইল	[illegible]
১	৩৭	৫১৬	১৬ অক্টোবর সন ১৯২৫	বারমেরামত	শেষ হইয়াছে।	
২	৫১	৬৫০	১১ নভেম্বর সন ১৯২৫	৩২৭নং পোলে রঙ্গ করা।	ঐ	
৩	৫৩	৬৭৫	১১ ডিসেম্বর সন ১৯২৫	পানাগড়ে নিম্ন শ্রেনীর লোকের জন্য ৩ খানী কোয়াটর তৈয়ারী করা।	কার্য্য আরম্ভ হইয়াছে।	
৪						
৫						
৬						

(ক) ইনেস্পেক্টরের নাম ও তাঁহার হেড কোয়াটারের নাম দিতে হইবে।

(খ) কণ্ট্রাক্টরের নাম।

(গ) ইঞ্জিনিয়ারের নাম।

(ঘ) ইঞ্জিনিয়ারের হেড কোয়াটর।

(চ) দফার নম্বর লিখিতে হইবে।

সাক্ষীর স্বাক্ষর————————কণ্ট্রাক্টরের স্বাক্ষর————————

সাক্ষীর স্বাক্ষর————————অপসৃত ইঞ্জিনিয়ারের স্বাক্ষর————————

এই ফরমে যেটার আবশ্যক নাই তাহা কাটীয়া দিতে পারেন এবং উহাতে কাণ্ট্রাক্টর এবং রিলিভড ইঞ্জিনিয়ার আপন আপন স্বাক্ষর করিয়া দিবেন।

CHAPTER IV.

AGREEMENTS WORK ORDERS, STRUCTURAL WORKS, MEASUREMENT, ETC.

23. In order to prevent contractors from putting in claims for work in excess of Work Orders given to them and to put the issue of Work Orders on a proper footing, the following notice printed in English, Urdu, Bengali and Hindi should be posted up in a conspicuous position at places where contractors come for payment, or at any other places considered suitable.

EAST INDIAN RAILWAY.

NOTICE TO CONTRACTORS.

Agreements and Work Orders.

No work is to be undertaken by any Contractor until he has been given a Work Order or Agreement signed by the Engineer, who is in charge of the work, nor must any work in addition to that entered in the Work Order or Agreement that has been signed by the said Engineer be undertaken by the Contractor until such additional work has been entered on the Work Order or Agreement and the entry duly signed by the said Engineer, who is the only person authorized to give Work Orders or Agreements to Contractors, subject to the approval of the District Engineer or the Superintendent, Way and Works.

The Contractor must satisfy himself before starting work that all items of work have been entered in the Work Order or Agreement, and that it has been signed by the Engineer who is in charge of the work.

No claim for any work done other than what is entered on the Work Order or Agreement will be entertained.

By order,

Engineer.

24. In order that there may be no mistake it is necessary that all units of calculations and rates in Work Orders and Agreements should be entered in words as well as in figures.

25. The approximate value of the work to be done should be entered at the top of each Work Order or Agreement.

26. Measurements of all work orders or agreements for Rs. 300/- and over are to be taken and entered in a measurement book by an Engineer in person or failing this measurements are to be endorsed "checked, verified and found correct" by an Engineer.

Measurement of work orders or agreements under Rs. 300/- may be taken and entered in a measurement book by an Inspector.

27. No works costing over Rs. 300/- may be divided into two or more Work Orders in order that the Engineer may evade the responsibility of measuring the same.

28. The practice of making out a Work Order *after* a work has been completed is highly objectionable and must on no account be resorted to except in cases of serious emergency.

29. Verbal orders are to be avoided. They are liable not only to misapprehension at the time but to be repudiated afterwards. They cannot therefore be accepted as a sufficient warrant for commencing any work or carrying out any deviation on the sanctioned plan of the work or incurring any liability. This is not, however, to interfere with the prompt obedience of every officer to the lawful orders of his superiors, but the written confirmation of such orders must be at once solicited by the officer addressed, failing which he will be held responsible for any expense incurred or any damage caused by the action taken.

30. No material alteration, to standard designs may be made in carrying out any work without the approval of the Chief Engineer. Should any alteration of importance involving additional expense be considered necessary a revised or supplementary estimate should be submitted for sanction. In urgent cases, where the delay thus caused would be inconvenient an immediate report of the circumstances must be made to the Chief Engineer (or the Divisional Superintendent where the work is under his control) and dealt with as the case may require.

31. Where important structural alterations are contemplated, though not necessarily involving an increased outlay, the orders of the original sanctioning authority should be obtained.

32. No structural alterations are to be made to any building without the sanction of the competent authority even when such alterations might not require sanction on the ground of expenditure.

33. All works must be carried out as rapidly as is possible with reference to the funds allotted and soundness of execution. All interruptions of large works in progress should be reported immediately to the Chief Engineer, the causes and probable duration of such interruptions being duly explained.

34. A strict record must be kept of the nature and depth of the foundations of all important structures. For culverts and small buildings a note on the drawing will be sufficient but for all major bridges, large buildings and generally all structures the depth of the foundations of which exceeds six feet

plans and cross sections and if necessary [illegible] should show the [illegible] must be prepared. These diagrams [illegible] through and reached, and reduced levels of the strata passed [illegible] They should be sub- and of all footing courses, plinths, etc. mitted to the office of the District Engineer or Superintendent, Way and Works, within one month after the masonry in the foundations has been begun.

35. All unusual *losses in the manufacture of materials* and all important accidents in building must, on *their occurrence*, be reported to the Chief Engineer, or Divisional Superintendent.

36. In the execution of works every care should be taken that the safety and convenience (by day and by night) of the public are duly attended to and that all operations are carried out in such a manner as to interfere as little as possible with the traffic or ordinary pursuits of the people. Drains or open founds in the neighbourhood of roads, paths or platforms should strongly be railed off or protected by efficient lamps at night. Temporary roads and bridges should be provided when necessary. The occupation of land when practicable should be so timed as not to interfere with or involve the destruction of standing crops.

37. No religious edifice shall be destroyed or injured in the execution of works without the full and free consent in writing of the persons interested in it; nor without the concurrence of the principal civil or political authority on the spot, except by the orders of the Local Government within whose jurisdiction the edifice stands.

38. Engineers and Inspectors should keep a note book in which they should record any particulars in regard to works in progress which they visit which may call for remark and any other matters that may come to their notice or orders that they may give or be given. These entries should invariably be dated.

38. (*a*) On each bridge or building of any importance which is under construction a note book should be kept in which the Engineer or Inspector should enter any information which will be of use in making out final bills or to his successor in case of his transfer. For instance lead of materials, daily labour, dates of any stoppage, recommencement of a work, causes of delay, class of founds, etc., may be entered.

CHAPTER V.

CONTRACTORS.

39. Contractors are the most important factors in getting work done quickly, cheaply and, with the requisite supervision on the part of the Engineer, in a satisfactory manner. All dealings with them, however, require great caution and tact.

40. Contractors obviously undertake work only for the sake of the profit they expect to make. All members of the Engineering Department should bear this point in mind when dealing with contractors and should treat them in a business like manner.

41. The majority of contractors work on borrowed capital, and it is impossible for them to make a reasonable profit *unless they are paid regularly* It is *absolutely essential*, therefore, that all work should be measured up at frequent intervals and "on account" payments made thereon. If delays in payments take place it means the contractor loses by having to pay a high rate of interest on his borrowed capital, and it follows therefore that if a contractor knows he is not likely to receive frequent and regular payments he will not tender for work except on high rates.

42. Henderson in his "Contract Manual" says—

> "Let communications of any appreciable conse-
> "quence be invariably written, and let correct
> "copies, mechanical if possible, be invariably
> "kept and be carefully safe guarded to the
> "utmost extent possible in practice and, where
> "the stress of practical business prevents this,
> "at least a note of the substance be made at
> "or near the time."

43. If there is any likelihood of a dispute with a contractor all documents, measurements, letters, etc, bearing on the case should be at once collected and locked up, and the keys kept in the custody of the officer responsible for the case. Cases have occurred where a contractor, with or without the connivance of some of the office staff, has got at and tampered with the documents or made away with them altogether.

44. The responsible Engineer should satisfy himself on the following points before engaging a new contractor:—

(*i*) His position as an independent contractor.

(*ii*) His ability to undertake and carry out the work satisfactorily, vouched for by a responsible official or firm.

(*iii*) His previous experience on work similar to that to be contracted for, in proof of which original certificates or testimonials may be called for by the Executive Engineer and the genuineness may be verified by reference to the officers who have given them. A copy of such certificates or testimonials should be filed for reference in all cases in Divisional offices.

(*iv*) His knowledge, from actual personal investigation, of the resources of the district in which the work tendered for lies, and his consequent acquaintance with the sufficiency of the rates tendered, and of the difficulties to be encountered and covered by such rates.

(*v*) His ability to supervise the work personally, or by a competent and duly authorized Agent.

45. Should the contractor intend that payments of all or any of his dues be made to an Agent, he must support the request by a proper power of attorney. To save delay the contractor should be advised to get legal opinion when drawing up his power of attorney. All such powers of attorney must be submitted to the Chief Accounts Officer for approval and acceptance.

46. Every endeavour should be made to obtain the signature of the contractor, or his duly authorised Agent, to all measurements. In cases where the contractor or his Agent refuses to attend when his work is being measured up, an *independent* witness must be obtained to the measurement, and a note should be made in the Measurement Book of the fact that the contractor or his Agent was given due notice to attend the measurements, but failed to appear.

47. Very often a contractor is supplied with materials, tools and stores. Great care should be taken to deduct the full amounts due on these from the first bill possible (This does not apply to bricks, lime, sand, etc., supplied to contractors working on labour rates, but would apply for instance to kodallies supplied to contractors working on earth work.) Clear receipts should be obtained from the contractor or his Agent for all such materials, etc., made over to him. Matters concerning these items should be settled promptly. Delay in such matters is often very costly. For materials, tools, etc., returned on completion of the work by the contractor a receipt should be granted promptly by the Engineering Subordinate in charge of the work. No *final* payment should be made until all deductions due have been cleared.

48. It should be made an invariable rule to have all contract documents completed and signed before a contractor is allowed to spend a rupee on the work.

49. In the case of earthwork such as widening of banks and cuttings it is important to obtain the contractor's signature on the original cross sections, and his acknowledgment in writing that the measurements shown thereon are accepted as the basis of his work otherwise when the work is completed a dispute may arise as to the actual quantity of work done.

50. Engineers in charge and Superintendents, Way and Works, should insist on their Assistants settling all contractors "up to date" at least once every three months, and clearance certificates should be obtained from the contractors stating that there are no miscellaneous claims outstanding. It is surprising what claims can be put forward at the end of the contract, unless the foregoing procedure is strictly enforced.

51. When a fraud is attempted by a contractor it is not sufficient to disallow the contractor's claims, but it is also necessary to make careful investigation of the actual amount of work done, and to record it in detail, so that the accuracy and completeness of the measurements can be proved unquestionably later on, if necessary, in a Court of Law.

52. In the case of any dispute with a contractor care should be taken to commence all correspondence with him with the headline "Without Prejudice." This safeguards the Railway should the correspondence be produced hereafter in a Court of Law.

53. In the event of a dispute with a contractor, when all reasonable means have been tried to effect an agreement, but the contractor refuses to sign the Final Contract Certificates, this Final Certificate should not be withheld, but be forwarded to the Chief Accounts Officer to tender payment. The contractor may accept payment if he wishes "Under Protest." If he does not do so but brings an action against the Railway in a Court of Law he cannot claim interest on the amount so tendered. He should be instructed to submit complete details of his claim in writing with a certificate to the effect that these are final.

CHAPTER VI.

MEASUREMENT BOOKS.

54. The practice of recording measurements of works or stores on slips of paper or in note books and again fair copying these entries into measurement books is irregular as copied measurements are absolutely useless and of no value as evidence in a Court of Law or otherwise.

55. The Measurement Book must be looked upon as a most important record since it is the basis of all accounts of quantities, whether of works done by daily labour, or by the piece or by contract, or of materials received which have to be counted or measured. The description of the work must be lucid so as to admit of easy identification and check.

56. For large works a separate Measurement Book may be set apart: or, if found more convenient, two or more books may be set apart for different classes of work.

57. The pages of the book should be machine numbered and no page should on any account be torn out, nor should an entry be erased or effaced so as to be illegible. If a mistake be made it should be corrected by crossing out the incorrect words or figures and rewriting the words or figures. Any such corrections must be initialled. The entries must be made directly in the Measurement Books at the site of the work. The copying of entries from another rough note book or similar record is strictly forbidden. A reliable record is the object to be aimed at, as it may have to be produced as evidence in a Court of Law.

All blank spaces on pages left blank by oversight should be cancelled by a diagonal red line with the word "cancelled" and initials and date put across.

58. The entries in the Measurement Book should be made in ink whenever this is possible. If however they have been made in pencil the actual measurement entered must not on any account be inked over. The calculated results under contents or area should however invariably be inked in.

59. Measurements should be taken by an Engineer or Inspector in the presence of the Contractor on his authorized Agent. Due notice should be sent to the Contractor advising him to be present. In the event of the Contractor failing to put in an appearance or to be represented a final letter by Registered Post may be sent him to the effect that his work will be measured up on a certain stated date whether he be present or not.

60. When measurements are made in the presence of the Contractor or his duly authorized Agent the entries in the Measurement Book should be signed and dated by the said Contractor or his Agent, but if they refuse to do so a note to this effect should be entered therein.

61. Measures must be taken by the District Engineer or Superintendent, Way and Works, for the systematic check of the entries in Measurement Books. For "on account" bills it is not necessary that the recorded measurements should rigidly represent the actual work done, but care should be taken to guard against overpayments. For "final" bills all the calculations in the Measurement Book should be carefully checked in the office of the Engineer in charge or Superintendent, Way and Works.

Engineers will save themselves much trouble if they make measurement "Final" for all works up to the bed level of a bridge or plinth or ground level of a building and obtain the Contractor's signed acceptance thereof as "Final". A Contractor cannot easily dispute measurements above ground level which can be measured at any time by any person.

62. Measurement Books have sometimes been found to have been tampered with and the figures altered. The Engineers should satisfy themselves that the details of the measurements on which the quantities are based have not been altered.

63. All quantities should be clearly traceable from the Measurement Book into the document (Contract Certificate) or bill on which payments are made: and a reference to this document as well as the date of preparation of the bill should be given by an endorsement upon the original entries in the Measurement Book, which should also be scored through on each page by a diagonal red line. No Contract Certificate or bill should be signed without thus crossing off the connected entry in the Measurement Book and the Contract Certificate should invariably bear a reference to the number and page of the book in which the detailed measurements are recorded.

64. While monthly payments need not be a hard and fast rule, and bills may be sent in oftener, if desirable, it should be made an invariable practice to measure up and pay for work done to date at least once every three months.

65. The register of Work Orders should be scrutinized at least once a month by Engineers and Inspectors and steps taken to have measurements recorded and bills submitted for all outstanding works that have been completed.

66. All the Measurement Books belonging to a Division should be serially numbered, and a register of them should be maintained in the Divisional office showing the serial number of each book, the name of the person to whom issued, the date of issue and the date of its return when the book is full. A similar register should also be maintained in all Engineers and Inspector's office. All books, which are in current use, must be kept in safe custody. The eventual return of all Measurement Books to the Divisional or Eye's office for record must be insisted on. They must be carefully preserved for ten years.

67. The rules printed at the commencement of each Measurement Book should be carefully studied and carried out.

CHAPTER VII.

RELATING TO LAND BOUNDARIES, ETC.

68. The District Engineers or Divisional Superintendents, Way and Works, should advise the Chief Engineer when they observe or receive information of any scheme which involves the acquisition of land adjoining East Indian Railway boundaries at important stations where there is a possibility of the Railway requiring additional land for extensions. This information should be transmitted to the Chief Engineer in order that the scheme may be investigated and Railway interests safe-guarded as far as practicable.

69. No land which does not belong to the Railway is to be entered upon or materials or minerals removed from same unless the Railway have previously been put in formal possession under the Land Acquisition Act or have entered into a properly executed agreement with the owner or obtained his permission in writing to take possession of such land on terms which are clearly laid down.

There have been instances in which Civil suits have been decided against the Railway due to a great extent to neglect in observing ordinary business methods. In some cases land has been taken possession of, and ballast broken and removed from the land without any terms having first been made with the owner. By exercising a little tact and courtesy in dealing with the owner an expensive and troublesome law suit might have been avoided in many such cases even if no satisfactory arrangement with the owner could have been made beforehand.

There is of course no denying the fact that in some cases land has been entered upon without the necessary permission in order to make a commencement with urgent work, but this is illegal. The Railway Staff have no more right than any other Company or individual to interfere with the property of other people except in case of accident as provided for under clause 9 of the Indian Railway Act IX of 1890.

70. Permanent-Way Inspectors and Inspectors of Works must make themselves acquainted with the boundaries of all Railway land on their sections, and must report promptly to the Engineer-in-Charge when they have reason to believe that encroachments have been or are being made on Railway land.

71. Engineers and Inspectors must see that rights of way across Railway land are not allowed to grow up.

72. Prompt action should invariably be taken to prevent squatters obtaining any rights to property in the custody of the Railway.

73. In all cases where B class land lay outside A class land the Government in selling it defined the boundary as "the Railway fence." Consequently the land outside the fence does not belong to us, whether that fence is according to the plan or not. Except where there never was B class land outside the A class land the limit of A class land shown on plans is our real boundary even if the fence is not correctly placed.

74. All land permanently occupied for the purposes of a Railway shall have its boundaries defined on the ground in such a manner as to enable such boundaries to be readily ascertained and identified.

For this purpose the boundary of the Railway land may be defined by a continuous wall, fence or ditch, or by detached marks, posts or pillars.

Where the boundary mark is continuous, the boundary of the Railway land is to be on the outer edge of the wall, fence or ditch, that is to say, the wall, fence or ditch will be situated wholly on Railway land.

Where detached marks, such as isolated posts or pillars, are used, the boundary of the Railway land will pass along the outside of such posts and pillars. Between the marks the boundary wall in each case is to be taken in a straight line from the outside of one mark to the out side of the next mark.

Boundary marks are to be placed at every corner point or change from a straight line

Detached marks are in no case to be at a greater distance apart (centre to centre) than one-eighth of a mile, *i. e.*, 660 feet. They are to be of a substantial character, not easily destroyed or moved by accident or mischief, and are to be of such a size and form as to be readily found and recognized.

Each detached boundary mark is to bear a number, and the position and corresponding number of each detached boundary mark is to be shown on the land plan.

Where a fence, wall or ditch is situated at some distance within the boundary and does not mark the actual limit of the Railway land, it will be necessary that, in addition to such fence, wall or ditch, the actual boundary of the Railway land shall be properly marked and defined in accordance with these rules.

EAST INDIAN RAILWAY.

Engineering Department Manual.

CORRIGENDUM SLIP No. 9.

In supersession of para. 77(a) page 21 *substitute* the following:—

(a) A license may similarly be granted to outsiders for the laying of pipes, the installations of electric wires, or such other necessary purposes In all these cases the Licens s should be renewed at least once in five years.

(b) No license for the purpose of cultivation should be granted to Railway servants. Gatekeepers and gangmen who are required to live in Railway quarters along the line outside station limits may however be permitted to cultivate only small plots of land in the neighbourhood of their quarters. No license for cultivating Railway land should on any account be granted in the Santhal Perganahs and for a period extending over a year at a time.

(c) This rule will not apply to special cases where land is leased to outsiders for cultivation under Railway Board's sanction nor to the leasing of Railway land to Recreation Societies among Railway Staff. In this case also the License should be renewed once a year.

CHIEF ENGINEER'S OFFICE,
Calcutta, 2*nd July* 1929.

A. C. DUNSDON,
for Chief Engineer.

W. O. No. 1364—1,500-10-7-1929.

75. All new fencing is to be placed on the actual boundary of the land belonging to the Administration and whenever old fencing is being renewed it is to be similarly placed on the boundary, any cases in which this cannot be done being specially reported for orders.

76. When during the execution of work it is necessary remove the fencing a Choukidar should be placed in to prevent cattle straying on the line, and immediate- on completion of the work the fencing must be re-erected made good.

77. In cases where Railway land may be required by outsiders for any purpose which can fairly be held to be a *bona fide* purpose of the Administration such as those marginally noted, a license may be granted, by the Divisional Superintendent, permitting the use of Railway lands for the purpose contemplated, at the same time such restrictions being imposed as may be necessary in the circumstances of each individual case.

(*i*) Erection of oil installations.
(*ii*) Warehouses, wharfs, or other premises for storing goods after arrival or before despatch by rail.
(*iii*) Shops for station vendors.

(*a*) In all cases the Licenses should be renewed at least once in five years.

A license may similarly be granted to outsiders for the laying of pipes, the installation of electric wires or such other necessary purposes and to Railway servants for the purposes of cultivation, etc., but no license for the purpose of cultivation in the Sounthal Parganahs is to be granted under any circumstances. No Licenses for cultivation should be granted for more than a year at a time.

78. Great care should be taken that the land actually handed over to us on acquisition is strictly in accordance with the land plans. It should also be seen that this land is free from encumbrances and that previous owners have been removed.

79. When settlement operations are being conducted by the Civil authorities, Engineers should watch the proceedings to see that the rights of the Administration to the lands vesting in Government are maintained and that no adverse rights are established.

CHAPTER VIII.

RULES FOR PREPARING PLANS

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80. The following are the authorized scales to which plans should be prepared:—

Plans and Sections—400 ft. to an inch horizontal; 40 ft. to an inch vertical.

Index Plans and Sections—1 mile to an inch horizontal; 100 ft. to an inch vertical.

Land plans—400 ft. to an inch: enlargements of same 100 ft. to an inch. On the old portion of the East Indian Railway the original land plans are to the scale of 150 ft. to an inch and 300 ft. to an inch. Plans for additional land should be drawn out to the same scales as the original plans.

Station Yard Plans—100 ft. to an inch—enlargements 40 ft. to an inch.

Block plans of properties—100 ft. to an inch—enlargements of details as required.

Plans and Elevations and Sections of Buildings—8 ft. to an inch. Details ½ inch to 1 ft. or larger scale as required.

Plans of sheds, girders, etc.—¾ in. to 1 ft. Details 1½ ins. to 1 ft. or larger scale as required.

Grades are to be laid out at "……………… per cent." and curves by even degrees and minutes.

81. All plans should be prepared so that they can be ferrotyped. The lines should be firm, and useless crowding of dotted lines representing roads and drains, etc., omitted. A single line is sufficient to represent such a feature as the side of a road A single thick line on a 100 ft. to an inch plan is sufficient to show the railway track—two lines for double track. Microscopic figures are to be avoided. A dimension can always be ticked out if the space is too small for legible figures.

82. When necessary to draw lines in more than one colour, only red, burnt sienna, yellow-ochre and green should be used. Blue may be used mixed with Chinese white. Gamboge should not be used on tracings.

83. Existing railway lines that are to be taken up or works that are to be dismantled should be shown in black dotted.

84. The Block plan is not the proper place to show such details as point rodding, etc. A plan to scale 40 ft. to an inch is more suitable for such a purpose. Where the necessary detail becomes too crowded the best way is to give an enlargement on the corner of the sheet and separate sheets can be prepared for any particular purpose such as a complicated system of water supply. The 100 ft. scale block plan is the general plan for reference and is not supposed to contain all the detailed information that can possibly be required Special plans should be made for special purposes and a reference to these can usefully be made on the main sheet.

85. On no plans are useless details such as the bricks or tiles of a building to be shown. The object of a plan is to tell the workman exactly what he has to do and nothing more.

86. A signal is to be shewn as viewed by the driver to whom it refers and with its foot if possible on the site it has to occupy.

87. The printing of the descriptive matter on a plan calls for attention. It is a common fault for a draughtsman to print on names in such a way that they are upside down to the reader. All matters should be printed in such a way that the Engineer looking at this plan can read everything with ease without moving the plan.

88. Plans should give the following *information* :—

The *scale* to which the plan is drawn.

The *North point* giving both magnetic and true North.

The *Mileage* from Howrah of the centre of the station building—the mileage of all junction points—the zero of all branch lines.

The original *centre line* of the railway.

The *Boundaries* of all land according to the land plans to be shown and marked "boundary of E. I. R. land". Where it does not unduly confuse the plan side widths from the centre line should be shown. The distances of two corners of all isolated plots of land from the centre line should be shown.

All *Fencing* to be marked and shown thus ——— . ——— . ——— . ——— .

All *Gates* to be shown thus .><. and wicket gates thus — x —. *Boundary walls* to be shown by a full line and marked with the word "wall" at convenient intervals.

Changes of *Gradient* with rail level at the point of change to be shown, also distance for which the level or gradient extends out of the station.

Any known *Bench Mark* with the datum from which the value of same is reckoned.

The degree, radius, total deflection angle, commencement and end of all *Curves* on main or branch lines.

All *Roads and Paths*, and if any road bounds our land this also should be shown. It should be stated where roads lead from and to.

Borrowpits to be shown.

Nallas and Drains to be shown.

Bridges—serial number, span or spans and description.

Buildings—position, block number, lettering of rooms. In the case of double storied buildings the upper floor should be shown dotted in any space convenient near the main building, the rooms lettered and the whole marked "Upper storey of Block No.   ".

Where outhouses occur they should be marked "O. H. to No.   ".

Temples, Mosques and Graves to be shown.

Length, width, and height of all *Stations and Goods platforms*.

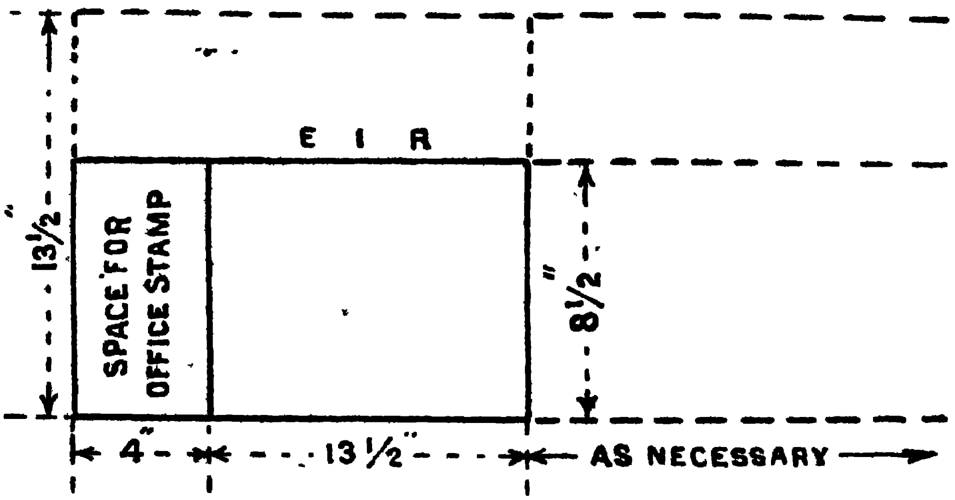
Length of all *Ashpits*; Tonnage of *Weighbridges*; diameter of *Turntables*, capacity of all *overhead tanks* and of all *Loco. ground tanks*; diameter and depth of all *Wells* whether drinking or Loco; diameter of all *Water Columns, Hydrants, Taps*; diameter of all *Pipe lines.* Pipe lines should be shown thus

Stop and Sluice valves thus – —X   .— Clear standing room of *Sidings*; position of *Clearance Boards*; distance centre to centre of tracks; distance of all facing points on double line and all main line points for passenger trains on single line from centre of station building;—the serial number of each point;—the angle of crossing;—the inclination of gathering lines;—the distance of all signals from the centre of station building, signal cabins, giving the number of levers they contain.

A point Indicator should be shown as a small circle on a stem with the circle filled in with black all miniature signals should be shown by a small semapore arm.

89. For preparation of plans, please refer to Chief Engineer's Standard Drawing No. 24 (revised).

90. Wherever possible plans for record at Official Meetings should be of foolscap size (13½ ins. long by 8½ ins. deep) with a margin 4 ins. by 8½ ins. at the left hand side for office stamp, etc. When a proposal cannot be efficiently shown on a plan of these dimensions the depth (8½ ins.) may be increased to 13½ ins., but should not exceed this and the length may be increased from 13½ to any extent as below:—



91. No plans should be less than foolscap size, *i. e.*, 13½ ins. by 8½ ins., with the 4 ins. margin on the left hand side.

92. Plans should be folded, so that they open out concertina fashion. The first fold should be 8½ ins. (the width of a sheet of foolscap paper) from the left of the plan, or 12½ ins. from the extreme left of the margin, and should be inwards, each succeeding fold should be 6 ins. apart and should open outwards and inwards alternately.

93. To slip the plan into a large envelope the first 2½ ins, from the left of the plan, or 6½ ins. from the extreme left of the margin, may be folded inwards if desired. No other folds should be permitted.

94. Where plans are not to be submitted at Official Meetings and where adherence to the above sizes would mean a sacrifice of clearness and easy reading any convenient size may be adopted.

95. The Standard size of drawings for sheds, girder bridges, etc., is "double elephant," *i. e.*, 40 ins. by 27 ins.; if required the length may be increased, but the width 27 ins. should be kept.

96. When prints are rolled for despatch they should be always rolled with the working side outwards.

97. All site plans for new quarters should give the type drawing numbers.

98. On plans of assisted and private sidings which are outside station limits a key plan to a scale of one mile to an inch should always be given showing the position of same.

The mileage from Howrah of the take off of the siding and the total length and the clear standing room of the siding should be given.

99. All plans except interlocking plans should be so drawn that the portion of the line nearest Howrah is on the right hand side.

100. In preparing plans care should be taken to avoid any wastage of tracing cloth. The plan should be made as compact as possible and the minimum of tracing cloth should be used.

101. Each Land plan should be prepared in a separate mile sheet. Revenue Districts and Sheet No. should be given. The names of villages to which land belongs are, in each case, to be written on the plan alongside of the line indicating the village boundary. If the boundary line crosses the railway line the names are to be repeated on the other side of the railway line and the chainage of the crossing point noted. Clear dimensions to be given for the land to be acquired, so that the area can be taken. A schedule as per Standard Drawing No. 24 (revised) to be given.

102. All plans for Railway Projects should be prepared in accordance with the Rules for the Preparation of Railway Projects issued by the Railway Board.

103. Every drawing submitted with an estimate should have a clear title, which should be shown on the back on two opposite corners, so as to show outside whichever way the paper be rolled up. The signature of every officer, through whose hands the drawing passes, should be affixed and dated.

CHAPTER IX.

RULES FOR PREPARING ESTIMATES.

Relating to Open Lines.

104. The preparation of estimates should be undertaken in such a manner as to secure as far as practicable the following results:—

Preparation of estimates (Chief Engineer's Circular No. 33 of 18th April 1925.)

(*a*) That when an estimate is submitted for sanction it shall be a trustworthy guide to the probable expenditure.

(*b*) That when an estimate had been sanctioned and the work is in progress—if an excess is for any reason unavoidable such excess shall be foreseen in good time and be provided for by a revised estimate or if it is found that the excess will be covered by the amount provided for in the Total Estimate a reappropriation statement should at once be submitted to regularize the Excess Expenditure from one Sub Head to another.

105. It is essential that the rates should be carefully considered, but it is no less important that all items which will be chargeable against the estimate shall be foreseen and provided for. The following is an extract from the first edition of the Government Rules for the Preparation of Railway Projects:—

> "**Estimates to be complete.**—The estimate for a work must provide for all expenditure necessary for the proper and complete execution of that work, and for all charges which will ultimately be debited thereto. The rates must therefore include a provision for all incidental expenses to be incurred specially for the work, such as carriage or manufacture of material—compensation and royalty, etc., tools and plants of a perishable, temporary or special character—depreciation of permanent way and other materials or plant used temporarily on such work, but afterwards to be used elsewhere also—for temporary works and diversions of the railway."

106. In addition to the usual charge of 5 per cent. for unforeseen contingencies, all incidental expenditure which can be foreseen, such as works establishment, sheds for workmen and stores, workshops, offices, or quarters should be separately provided for in the estimate. The provision for contingencies may not be diverted to any new work or repair which is not provided for in the estimate, and of which the cost exceeds Rs. 200, without the sanction of the Agent.

107. There is no restriction as to the classes of establishment whose pay may be charged to works, but the following conditions must be fulfilled before the pay can be so charged :—

(1) The persons must be employed for the subordinate supervision or accounting for stores and labour.

(2) They must be paid by the day or month, their employment ceasing with the cessation of the work.

(3) The cost must be shown as a separate sub-head of the estimates, *viz*, Works (or Temporary) Establishment

(4) The rate of pay must in no case be more than Rs. 250 per mensem.

Note—The pay of draftsman and clerks other than "Store" and "Muster" clerks actually employed at the site of works is not to be charged to works as "work establishment"

Any other additional establishment required must be applied for through the Chief Engineer and be duly sanctioned before being entertained and will cease to be employed on the completion of that work.

108. In preparing estimates every care must be taken to see that due provision is made under the heading "establishment" but if any such charges are unforeseen and additional establishment is required, sanction should be obtained and the expenditure should be shown against "establishment" and not against "contingencies", the excess being subsequently provided for in a revised estimate if necessary or explained in the Completion Report

109. If a Supervisor, such as an Inspector of Works, is actually employed on the supervision of two or more jobs, his pay and allowances should be charged proportionately to those works.

110. It is not desired that a high estimate should be sent in to provide a "factor of safety" (as it were) against unforeseen expenditure, but what is desired is the exercise of due care and foresight in the preparation of each estimate so that it may give as close an approximation as practicable to the actual necessary cost of the work.

111. A complete estimate consists of—

References
Report
Abstract
Details
Allocation statement.

It should state concisely :—

(*a*) the reasons for the proposal,

(*b*) any remarks about rates, which are likely to be called in question,

(*c*) any notes upon points of design or execution that seem likely to require discussion.

112. In the report accompanying an estimate a very brief but clear description of the nature of the work to be carried out should be given: also a brief note as to why the work is required. The description should give as far as possible sufficient information to show what work is contemplated without reference to the drawing. The time within which the work may be expected to be completed must also be mentioned. It should further be stated whether the work is urgent or otherwise The report should be arranged in the following sequence as far as applicable :—

(*a*) Present state of affairs.

(*b*) Disabilities of the present state which it is proposed to rectify.

(*c*) What it is proposed should be done, *i. e.*, what the estimate is for.

(*d*) Anticipated savings in working expenses or other justification if any.

113. Stores should be divided into those "In hand" and those "To be purchased". Only 2nd hand articles or surplus stores should be shown as "In hand".

114. New materials such as corrugated iron, wooden sleepers or other timber required should be shown as "To be purchased" as although they might be in stores at the time they would require to be purchased to recoup the stock issued.

115. As far as possible items of estimates chargeable to the same head or sub-head of account should be grouped together. This admits of the number of items under which expenditure is posted in the Register of Works being reduced to a minimum without in any way impairing the efficiency of the Register.

Rules governing the allocation of expenditure to capital, to the depreciation fund, and to revenue.

116. I. Capital bears :—

(*i*) the first cost of construction and equipment of the line;

(*ii*) the cost of maintaining a section of the line not opened for working;

(*iii*) the cost of any addition to the line or the equipment of the line when estimated to cost more than Rs. 2,000, except of a temporary or experimental work;

(*iv*) any excess in the cost of replacing a work or article of equipment (except a temporary or experimental work or a work originally estimated to cost Rs. 2,000 or less) over the cost at debit to capital of the work or article replaced;

NOTE 1.—If a temporary or experimental work is replaced by a permanent work, the whole cost of the permanent work is charged to capital, if estimated to cost more than Rs. 2,000.

NOTE 2.—The total cost of replacing a work originally estimated to cost Rs. 2,000 or less is charged to capital, if estimated to be over Rs. 2,000.

(*v*) the cost of any appointments specially created for the supervision or construction of a work chargeable to capital, and a proportionate share of the cost of any such appointments, where the cost of work is chargeable partly to capital and partly to the depreciation fund or to revenue;

(*vi*) the cost of land.

II. Capital is credited with :—

(*i*) the difference between the cost at debit to capital of a replaced work or article and the cost of replacement, where the cost of replacement is less than the cost at debit to capital;

(*ii*) the cost at debit to capital of any work or article of equipment which is abandoned or disposed of without being replaced.

III. The depreciation fund bears :—

(*i*) the original cost of any of the units shown under the following classes of assets, when a unit is replaced :—

Class of asset.	Normal life.	Unit.
	Years.	
1. Bridge work Steel work	60	1. An entire span of girders. 2. Steel work on an individual bridge originally costing more than Rs. 10,000.
2. Bridge work—Masonry	125	An entire abutment, pier or arch.

Class of asset.	Normal life.	Unit.
	Years.	
3. Permanent Way—Rails and fastenings including pionts and crossings.	60	Rails and fastenings points and crossings.
4. Permanent Way—Sleepers—wood.	15	Sleepers, wood.
5. Permanent Way—Sleepers—Cast iron and ferro concrete.	40	Sleepers, cast iron and ferro concrete.
6. Permanent Way—Sleepers—Steel trough.	30	Sleepers steel trough.
7. Buildings—Masonry ...	200	1. An entire building. 2. A part of a building when the part originally cost more than Rs. 25,000.
8. Buildings—All others ..	50	1. An entire building. 2. A part of a building when the part originally cost more than Rs. 25,000.
9. Station machinery ...	40	An entire unit of station machinery.
10. Plant	20	An entire unit of plant or an entire machine. NOTE.—Loose hand tools do not constitute a unit.
11. Ferries	40	An entire vessel, engine or boiler.
12. Rolling stock—Locomotives Engines and tenders.	35	1. An entire engine. NOTE.—The depreciation fund bears the cost of rebuilding an engine if the work is undertaken as one operation. 2. An entire tender.
13. Rolling Stock—Locomotive boilers.	25	An entire boiler.
14. Rolling Stock—Carriage, and Wagon—Coaching vehicles.	30	An entire vehicle.
15. Rolling Stock—Carriage and Wagon—Goods vehicles.	40	Ditto.
16. Motor vehicles—Rail ...	20	Ditto.
17. Motor vehicles—Road ...	10	Ditto.
18. Electric instruments and telephones.	13	All articles.
19. Electric power stations and Sub-stations—buildings.	30	1. An entire building. 2. A part of a building when the part originally cost more than Rs. 25,000.
20. Electric Power Stations—Plant.	20	An entire unit of plant or an entire machine.
21. Electric Locomotives ...,	35	An entire Locomotive.
22. Electric overhead equipment of track.	50	All articles.

(*ii*) the credit to capital under rule 2 when a complete unit as described in clause (*i*) of this rule is replaced, abandoned, or disposed of.

NOTE.—The credit to capital is given when the unit is replaced, abandoned or disposed of.

IV. The depreciation fund is credited annually with an amount equivalent to the total expenditure to the end of the previous financial year on all the units of each class of asset as described in rule 3 (i), divided by the number of years assumed as the normal life of that class of asset provided that no credit shall be given on account of any unit after the period assumed for its normal life has expired. The effect of the rule prescribed in this paragraph is that when a unit is replaced or abandoned or disposed of before the expiry of its assumed normal life the credit on its account to the depreciation fund continues until the expiry of its assumed normal life. But in exceptional cases, where replacements, involving substantial amounts are undertaken many years before the expiry of the assumed normal life of a unit or units, a revision of the entries in the record of depreciation may be made so as to avoid double payments into the depreciation fund in respect of such units, both on the original cost of the unit and on the cost of replacement. All such cases should be referred for the specific orders of the Railway Board.

No credits or debits should be made to the depreciation fund on account of temporary or experimental works, or additions costing Rs 2,000 or less.

V. Revenue bears all other charges including :—

(*i*) the cost of temporary and experimental works ;

(*ii*) the cost of any addition to the line or the equipment of the line, when estimated to cost not more than Rs. 2,000.

(*iii*) such portion of the cost of any appointments specifically created for the supervision or construction of a work chargeable partly to capital and partly to the depreciation fund or to revenue as is not borne by capital under rule 1 (*v*).

(*iv*) the credit to capital under rule 2 when it is not borne by the depreciation fund under rule 3 (*ii*).

(*v*) the original cost of any work or article of equipment replaced, when it is not borne by the depreciation fund under rule 3 (*i*).

(*vi*) the credit to the depreciation fund under rule 4.

VI. Revenue is credited with any amount received from the disposal of a work or article of equipment.

117. The acquisition of land is a capital charge whether the cost is under Rs. 2,000 or not.

118. It is not sufficient merely to allocate between Capital, Depreciation Fund and Revenue, but against each item or group of items the Capital, Depreciation Fund or Revenue sub-head of account to which it is chargeable should be quoted in the remarks column.

119. Credits given for articles to be obtained from works dismantled or abandoned are sometimes considerably in excess of what the Controller of Stores will allow for such articles when they are returned to Stores.

The fact that there is little demand for second hand materials, plant or machinery of obsolete patterns and that the Controller of Stores has generally to dispose of these at little more than scrap rates, must not be lost sight of. When estimating for any work from which materials, plant or machinery of obsolete pattern will be released which it is proposed to return to Stores credit should be taken only at such rates as the Controller of Stores is likely to allow. If necessary a reference to the Controller of Stores should be made before the estimate is submitted. Fair credits may be given for second hand material which will be utilised in other works.

120. The probable date of completion of the work should be noted at the foot of the estimate also whether this depends upon the receipt of stores from England or on any other cause.

121. Information should also be given at the foot of the estimate as to whether necessary provision for the work has been made in the Quinquennial Programme or if no such provision exists how it is proposed to find funds.

122. Fractions of a rupee are to be omitted in all estimates.

123. The naming of estimates is an important matter to which the personal attention of Engineers should be given. The name should be clear, brief and distinctive.

124. Once an estimate has been sanctioned the "Name of work" as sanctioned must be adhered to without alteration.

125. Each estimate or batch of estimates is to be submitted under a separate and distinct covering letter.

126. Estimates belonging to entirely different projects, though for works of the same character, are to be prepared on separate forms and submitted under separate forwarding letters.

127. Estimates forming part of a comprehensive project are not to be submitted piecemeal. The cost of each independent work should be shown as a subsidiary estimate, whilst a General Abstract, which includes all subsidiary estimates, will serve to show the total cost of the project.

128. Where alternative proposals are made separate estimates should be prepared for each, together with a General Abstract showing in tabular form the comparative cost of the various alternatives. The alternative estimates need only be rough approximations in the first instance.

129. As a rule, and in the absence of other instructions similar works whether at the same station or at several stations required at the same time and works not of a similar kind, but interdependent and connected by the same general idea, as for instance "Additional accommodation and improvements of yard required at a station owing to the increase of traffic" should be grouped together in one consolidated estimate for the entire scheme, however small may be the estimated cost of each individual work and the estimate so framed should be submitted for sanction to the authority competent to deal with the aggregate cost of the scheme

130. When submitting designs and estimates for remodelling traffic yards for the sanction of the Railway Board, information in the following tabular form should be furnished.

			Existing	Proposed.	Future extension proposed
(1) Capital outlay including land, permanent way, buildings, etc., on all requirements for working the traffic yard including quarters for the station staff.					
(2) Ditto for Locomotive yards					
(3) Number of railway routes entering the station.					
(4) Daily number of trains.	Inwards	Max. .			
	Outwards ...	Average			
(5) Daily number of trains,	Marshalled	Max. ...			
		Average			
For how many destinations.					
(6) Daily tons of goods.	Inwards ...	Max .			
	Outwards ...	Average			
(7) Daily passengers booked.	Inwards ..	Max. ...			
	Outwards ...	Average			
(8) Number of engines stabled ..					
(9) Cost of signalling and interlocking per lever.					

131. In submitting revised estimates for sanctioned works the amounts of sanctioned estimates should be shown in additional columns against each item of the revised estimate to show clearly in what items the estimates have been revised or exceeded and by what amounts. Brief explanation of the differences should be given.

132. No material alteration in the character of a work as provided for in an estimate and no new work not provided for in the estimate should be permitted or undertaken without the prior approval of the authority which has sanctioned the estimate.

133. If any work or works are found to be urgently required it is necessary to submit Urgency Certificates for the same in duplicate giving the following information :—

(This Certificate should always be submitted when it is proposed to commence a work before plans and estimates can be submitted.)

(1) Description of work.

(2) Date of commencement of work.

(3) Circumstances which bring work under the Category of Urgency.

(4) Maximum probable cost.

(5) Date by which detailed estimate will be submitted.

(6) Allotment of funds necessary.

(7) Remarks.

134. All classes of estimates and completion reports submitted for sanction to the Head of the Railway or the Railway Board should be countersigned by the Chief Auditor in token of his acceptance as being unobjectionable from the audit standpoint.

135. The following units of work are prescribed :—

	Unit of rate.
Land	Per acre.
Earthwork	Per 1,000 cubic feet.
Well Sinking	Per running foot.
Steel work	Per ton or cwt.
P. Way	Per foot.
Ballast	Per 100 cubic foot.
Fencing	Per Lineal foot.
Brickwork or masonry	Per 100 cubic feet.
Concrete	
Road metalling	
Pitching	
Woodwork	Per cubic foot.
Painting	Per of 100 square feet.
Plastering	
Flooring	
Roofing	
Turfing	
Doors and windows	Per square foot

136. An order to prepare an estimate is no authority for the execution of a work and verbal orders, as being liable to misapprehension, will not be accepted as a sufficient warrant for commencing any work or incurring any liability. This is not, however, to interfere with the prompt obedience of every officer in the department to the lawful orders of his superiors; but the written confirmation of such orders or requisitions, within a reasonable time, must be at once solicited by the officer addressed, and he will be responsible for any expense thus incurred, unless he can show that he has conformed to this rule, stating details and giving a rough estimate of the expense.

137. All works must be carried on as rapidly as is possible with reference to the funds allotted and soundness of execution. All interruptions of large works in progress should be immediately reported to the Head of the Railway Administration, the causes and probable duration of such interruptions being duly explained.

Letter No. 311 F.-18 of 19th November 1923 from Railway Board. Reso. 985 of 1924-25.

138. The Sterling transactions involved in estimates should be converted into Indian money at the rate of 1 *s.* 6 *d.* per rupee.

CHAPTER X.

ON OPENING NEW WORKS.

139. The requirement to be complied with in this connection are contained in the Rules for the opening of a Railway or section of a Railway for the Public Carriage of Passengers issued by the Government of India, 1923.

140. The Railway Act provides for the opening of works under varying conditions according to the circumstances under which the works have been constructed—and to comply with the orders of Government, it is necessary for Engineers to follow whichever of the courses laid down below may be appropriate to the circumstances —

141. **A—In cases of accident.**—When on the occurrence of an accident, it is necessary to open without delay a new work or the restoration of a work, section 21 (*a*) and (*b*) of the Railway Act must be strictly followed according to the sample form E. 41 B attached (Appendix B) page 44.

142. The certificate, in which all infringements, if any, of existing Government of India Standard Dimensions should be noted, must be filled in and signed by the Engineer-in-charge of the work *before* the work is opened and telegraphic notice must be sent to the Government Inspector of Railways concerned and to the Chief Engineer immediately after the work has been opened in the following form:—

"Temporary works in connection with accident at______

opened for public traffic at on
no danger to public, certificate forwarded".

143. The original signed certificate will be forwarded to the Engineer-in-charge or Superintendent, Way and Works, who will forward it in original to the Government Inspector and also a copy of the certificate to the Chief Engineer.

144. Diversions should in all cases be tested by running a ballast train or Light Engine over them before opening for public traffic.

145. B—In the case of new work carried out in the ordinary course other than interlocking installations.— In lieu of one month's notice prescribed in section 17 (1) of the Act, not less than fourteen days notice of the intention to open a work is required by the Government Inspector. The Engineer-in-charge or Superintendent, Way and Works, will ask in Form E. 41A (Appendix A) for permission to start the work and will enquire whether the Government Inspector wishes to inspect the work prior to opening or not; and to enable the Government Inspector to judge whether it is necessary for him to inspect the work prior to opening, the notice should be accompanied by such description, scaled and dimensioned drawings and other information regarding the work as will render its nature clear to the Government Inspector, mention being made of any system of signalling or special train working which is to be adopted. The description or drawing should state or show gradients, where steeper gradients than 1 in 400 occur within station limits.

No such work shall be commenced until permission of the senior Government Inspecter in form E. 41 A Page 42 has been obtained

146. Under the Railway Board's Circular No 1012, dated 4th June 1909, and under the Rules for the Opening of a Railway 1923, the sanction of the Government Inspector to the use of Locomotives should be requested when sanction to the opening of work is being applied for.

147. If the new work includes a station, or any work requiring rules for traffic working, the rules will be submitted to the Government Inspector along with the application to commence work in form E. 41A (Appendix A) These rules will be signed by the Chief Operating Superintendent or Divisional Superintendent in token of approval and will be supplied to the Engineer-in-charge or Superintendent, Way and Works Form E. 41A will be sent in duplicate to the Government Inspector, who will keep the original as his office copy and the duplicate copy will be signed by him and returned to the Engineer-in charge or Superintendent, Way and Works, with sanction to proceed with the work.

148. If the Government Inspector decides not to inspect prior to opening, the Assistant Engineer, on necessary intimation to this effect, will, when the work is completed and ready for opening, after personal inspection of the work, prepare a certificate on form E. 41B given in appendix B and will forward it to the Engineer-in-charge or Superintendent, Way and Works and then proceed to open for public traffic. As soon as the work of connecting up the lines with the running track has been completed, the Assistant Engineer will send by telegraph a message to the Government Inspector quoting No. and date of Government Inspector's letter giving authority, in the following form :—

"Your letter (or telegram) No.__________of __________
work opened at the______________ on (date) __________
no danger to public, certificate forwarded."

and will at the same time advise all concerned of the fact by telegraph. The Engineer-in charge or Superintendent, Way and Works, will forward the original signed certificate to the Government Inspector to satisfy him that provisions (*b*), (*c*), (*f*) of sub-section 1 of section 19 of the Act have been duly fulfilled, and will forward a copy of the certificate to the Chief Engineer for submission through him to the Agent.

NOTE.—1. The Railway Board have recently drawn repeat d attention to the fact that they wish the Standard Dimensions adhered to, any Infringements thereof requiring their prior sanction before the work is put in hand.

2 It is the Government Inspector's duty to inspect all newly opened works as soon as possible after opening, and all works opened for traffic prior to inspection should be brought to his notice at the next periodical inspection by the Engineer-in-charge or Superintendent, Way and Works, concerned.

149 If on the other hand, the Government Inspector decides to inspect prior to opening, the Engineer-in-charge or Superintendent, Way and Works, will arrange a suitable date for inspection in communication with him, and will be present at the inspection.

150. The Government Inspector will as required by the Rules communicate to the Agent in writing the authority to open the work concerned The work having been opened the Engineer-in-charge or Superintendent, Way and Works, will send advice of the fact by telegraph to the Agent, Chief Engineer and all concerned and will at the same time mention what restrictions as to speed, if any, have been imposed.

151. C—In the case of bringing into use of or Alterations to Interlocking Installations.—The following rules apply only to interlocking of points and signals or to the provision of signals which affect or apply to the movement of passenger trains.

152. No locking frame may be brought into use until a tracing of the locking table has been submitted to and signed by the Government Inspector.

This tracing of the locking table must in all cases be sent by or through the Deputy Chief Engineer, Signals and must bear his signature.

A ferro of the tracing signed by the Government Inspector will be sent to the Engineer-in charge or Superintendent, Way and Works, as authority to commence work. A ferro will be supplied by the Chief Engineer for record in the Government Inspector's Office.

153. Similarly, no new installation of signals, even though of a temporary nature, may be put in hand until a plan of same (not necessarily to scale) has been submitted to and signed by the Government Inspector.

The plan must in all cases be sent by or through the Deputy Chief Engineer, Signals and must bear his signature.

A ferro of the plan (tracing) signed by the Government Inspector will be sent to the Engineer-in-charge or Superintendent, Way and Works, as authority to commence work. A ferro will also be supplied by the Deputy Chief Engineer, Signals, for record in the Government Inspector's Office.

154. Before the work can be opened the Engineer-in-charge or Superintendent, Way and Works, must forward Form E. 41A to the Deputy Chief Engineer, Signals for submission to the Government Inspector, together with a copy of the proposed Traffic Working rules.

155. When the Government Inspector has accorded sanction to the work being brought into use and has approved of the Traffic Working rules, the Engineer-in-charge or Superintendent, Way and Works will arrange for the usual Gazette Notification.

On the day of opening the Engineer-in-charge or Superintendent, Way and Works will forward a Safety Certicfiate (E 41B) to the Government Inspector which must be countersigned by Deputy Chief Engineer, Signals.

156. After the installation has been brought into use, the Engineer-in charge or Superintendent, Way and Works, will as soon as possible in a week or such time as may be necessary to ensure that all connections are in the wright adjustment forward to the Government Inspector through the Deputy Chief Engineer, Signals an interlocking catechism duly filled in and signed together with a scale plan (preferably 100 feet to an inch) showing the position of cabins, lever frames, signals, standing room of sidings or loops, centres of tracks, gradients, etc., and apply for sanction to be accorded to the station or installation being regarded and classed as "Interlocked." On obtaining this sanction from the Government Inspector, the Engineer-in-charge or Superintendent, Way and Works, will advise the Divisional Superintendent accordingly and the latter will arrange for the classification to be noted in the Gazette and in the Working Time Table.

157 When once a station has been classed as "Interlocked" no signal may be erected or removed, no interlocked points may be put in or taken out, nor may the interlocking of the frame be altered or added to, in any way, unless a plan (not necessarily to scale) showing the alterations has been approved and signed by the Government Inspector.

158. D—In Case of works of Emergency.—It may be necessary at times to move sidings or do other emergent work before the Government Inspector's sanction can be obtained under the procedure laid down in Section II. In such cases the Engineer-in-charge or Superintendent, Way and Works, will by telegram ask the Chief Engineer to obtain the sanction of the Government Inspector to the work being undertaken.

159. In all other respects, the procedure in such cases will follow the course prescribed for ordinary works, and the emergent procedure will only be resorted to, if it becomes necessary, to open the work at any time before the completion of the usual proceedings.

160. E—In the case of Ghat siding.—On obtaining previous sanction from the Government Inspector for the whole season, the Agent is authorised to make any alteration at Ghat Stations that the rise and fall of rivers may necessitate. No other intimation of such works need be sent to the Government Inspector beyond a telegraphic notice of their opening, provided that (1) the alterations are within station limits, (2) speeds do not exceed 10 miles an hour, (3) a plan of the alterations affected is submitted together with any necessary Traffic Rules. The telegram is to be addressed to Chief Engineer, with copies to Government Inspector, Chief Operating Superintendent and others concerned.

161. F—Except as described in Rule I no new work affecting the running of trains or the working of traffic at stations is to be brought into use until the staff have been notified of the same by a notice in the Weekly Gazette.

162. If any deviation from the plans authorised by the Government Inspector which will affect the lay-out of lines or arrangements of signals is made, revised plans, working rules, &c., must be submitted to him for approval.

APPENDIX A. E. 41 A.

No.________

FROM

THE $\frac{\text{ENGINEER-IN-CHARGE.}}{\text{SUPERINTENDENT, WAY AND WORKS.}}$

East Indian Railway.

TO

THE $\frac{\text{SENIOR}}{\text{JUNIOR}}$ GOVERNMENT INSPECTOR OF RYS.

Calcutta

*the*__________

SIR,

* Here enter name of work

Application for sanction to*________

I solicit your sanction to the above named work being commenced and opened for public traffic when ready.

2. With reference to Chapter VI of the rules for the opening of a railway, I beg to enquire whether you wish to inspect the work prior to opening to public traffic, if so, please inform me, and due intimation will be given of the date of completion.

3. In the event of your deciding not to inspect the work prior to opening I will, on completion of the work, despatch a telegram to your address, intimating that the work has been opened.

† If no description is necessary, or there are no infringements, or restrictions, *Nil* may be written after the items.

4 †The following documents are enclosed :—

(*a*.) Plan and section.
(*b*.) Description.
(*c*.) List of infringements
(*d*.) Restrictions.
(*e*.) Rules for traffic working.

Engineer-in-charge.
Superintendent, Way and Works

No.________

FROM

THE $\frac{\text{SENIOR}}{\text{JUNIOR}}$ GOVERNMENT INSPECTOR OF RYS.

$\frac{\textit{Calcutta}}{\textit{Lucknow.}}$

TO

THE $\frac{\text{ENGINEER-IN-CHARGE.}}{\text{SUPERINTENDENT, WAY AND WORKS.}}$

East Indian Railway,__________

the __________192

SIR,

YOUR No.__________

Sanction is accorded to the above work being commenced and opened for public traffic when ready.

I $\frac{\text{do}}{\text{do not}}$ propose to inspect the work prior to opening for public traffic and
advice of when the work will be ready for inspection should be intimated at least 14 days before it is proposed to open it
it will suffice if a safety Certificate, as provided in para 3 of your letter is submitted to me direct at the time of opening.

Senior Government Inspector.

APPENDIX B. E. 41 B.

EAST INDIAN RAILWAY.

Certificate to be signed and despatched before Opening Temporary or New Works.

[Form to be sent on completion of work by the $\frac{\text{Engineer-in-charge}}{\text{Superintendent, Way and Works}}$ to the Senior Government Inspector a copy being sent to the Chief Engineer at the same time for submission to Agent.]

* Here enter name of work.

I do hereby certify that, in the work above mentioned —

(1.) The fixed dimensions prescribed by the Governor General in Council have not been infringed; except as shown in attached list

(2.) The weight of rails, strength of bridges and general structural character of the works are such as have been prescribed.

(3.) And I have satisfied myself by personal inspection that the work can be opened for the public carriage of passengers without danger to the public using it.

Assistant Engineer.

No. ____, *Dated* ____ __________ 192 .

FORWARDED to the $\frac{\text{Senior}}{\text{Junior}}$ Government Inspector.

$\frac{\textit{Engineer-in-charge.}}{\textit{Superintendent, Way and Works}}$

CHAPTER XI.

BRIDGES.

A.—Manitenance, inspection and records pertaining thereto.

163. Assistant Engineers will arrange to obtain the records of the highest flood levels at all Bridges, culverts and openings

This information should be obtained when the flood is at its maximum. If particulars are not *carefully* noted at this time the traces may be lost and in any case the information obtained will be open to doubt.

When a bridge is known to be in any way defective or weak special steps must be taken to insure regular inspection at least quarterly.

164. When it is desired to ascertain the afflux at a particular bridge or culvert if the said bridge or culvert be small it is desirable to take the levels of the water at points on the bank 50 feet or 100 feet away from the bridge or culvert on both sides of the line where there is still, or comparatively still, water. During the flood pegs may be driven in at these points at water level and the difference in values of these determined later. At the bridge itself there is always too much turbulence in the water to obtain accurate values.

165. When carrying out bridge inspections Engineers and Inspectors should compare the notes and orders of previous Inspections and add whatever have since been taken relative to such bridges and culverts as required attention at that time, and in reporting on these bridges and culverts, special notes shall be made as to whether the repairs and recommendations of the previous examinations have been fully carried out or not.

166. See if the waterway requires straightening, cleaning out or enlarging and whether pitching is needed to maintain the channel or protect the embankment.

167. Examine piers, abutments and breast walls as to joints, settlement, imperfect stones or bricks, cracks, or other defects. Note if the work needs pointing, or if cracks have opened since it was last pointed; make such measurements as will locate the position of cracks and illustrate with sketches if necessary. Note the condition of the pitching, if any. State if pitching is needed to prevent undermining and if so how much. Give the condition of the bed stones, and say whether girder seats are clean and water drained off.

168. Note the condition of arches and retaining walls. See if they are yielding by settlement or bulging from the pressure of the embankment or of filling under the track.

169. Note the condition of flooring, apron, and pitching and that the same is so placed that it cannot be undermined by scour.

170. See if the bed plates and rollers are clean, and if the latter are placed so as to move squarely backward and forward with the girders. See if the bearing plates take an even bearing on the rollers. Examine the holding down bolts

171. Observe particularly the condition of the bed timbers where the girders rest upon them. Note any appearance of crushing or decay.

172. Note if there are any members, such as closed columns, bottom booms, etc., which catch and retain water by reason of not having proper drain holes.

173. Note any undue vibration of the structure under the moving load.

174. Note excessive deflection of the structure under the moving load and see if the two trusses have the same deflection.

175. See if any rust spots are apparent. Note if structure needs repainting. Steel or iron bridge work should be scraped and repainted as often as necessary to preserve it from rusting.

176. The tension in flat tie bars should be tested by springing them. Round tie bars with screwed ends or couplings should be tightened up to give a slight tension.

177. Weak girders usually give signs of weakness by loose rivets at the following connections—

(*a*) Verticals and diagonals to main booms
(*b*) Rail bearers to cross girders, and cross girders to main girders.
(*c*) Field joints.

When inspecting girder bridges, the rivets at these places should be particularly examined, and loose rivets are to be replaced as soon as possible.

178. Note if any small girder spans have been affected by creep in the rails laid over them, as they occasionally require to be replaced in their correct position. Horizontal bracing should be provided when one girder in a span creeps more than another, and drawings for this will be supplied for each particular case on application to the Chief Engineer.

179. Note if ladders or stagings are required to facilitate inspection and if so where they are kept. They must be provided where necessary.

180. See that trees, weeds, vegetation or rubbish is properly removed or otherwise disposed of. All trees growing on the masonry of bridges should be thoroughly rooted out and the joint repointed.

181. To enable Engineers and Inspectors to examine the under sides of bridges with facility a good path should be made and maintained at each masonry or girder bridge in a suitable position from formation to the ground underneath the bridge.

182. Plates indicating the depth of the foundations are to be fixed on the piers and abutments of all new bridges of 10 feet span or over as soon after completion as possible. There are two types of plates as per Chief Engineer's Drawings Nos. 31934 and 31935 one being for well foundations and the other for open foundations. One plate is to be fixed on each pier and abutment above flood level so as, if possible, to be visible from the bank or from adjoining piers.

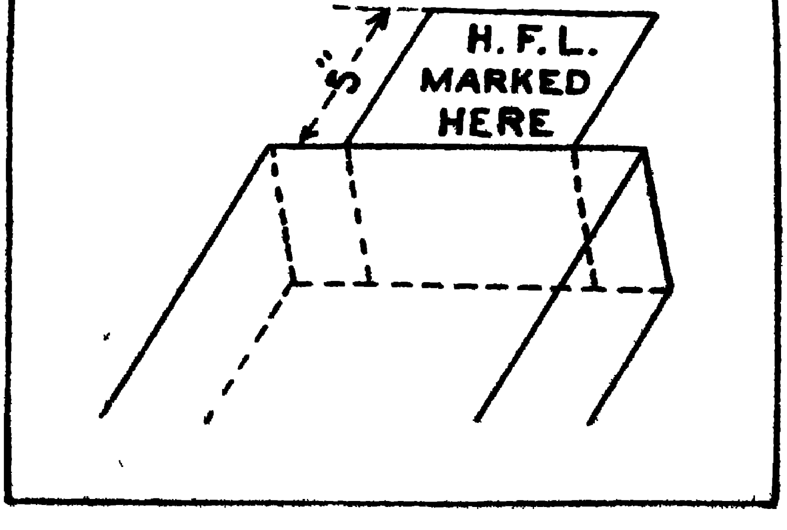
183. Inspectors must mark the highest known flood level on the masonry at each bridge, culvert and opening, and when there are floods which rise above these levels the new highest flood levels should be marked at once. Any new highest flood levels should be reported to their Engineers and thence to the Chief Engineers at once to enable them to be recorded in their office copies of the section of the line.

183-A. The importance of preserving accurate levels of floods and recording them on the bridges, in places where their values can be easily seen, should be impressed on every Engineer, and it should not be left to the imagination of Inspectors to indicate flood levels as and where they think fit.

Ordinarily, on bridges of 1 to 3 spans it will suffice if the flood level is marked on the right abutment, facing the flow of the river, or, if the water does not reach the abutment, on the pier.

In the case of bridges of 4 to 10 spans the highest flood level should be marked on both abutments or on both piers nearest the abutments if the water does not reach the former.

In longer bridges the flood level should also be marked on a pier in the middle of the bridge and a small iron plate indicating the pier should be fixed on the end of one of the sleepers over the pier at an angle of 60°, as shown in the sketch below :—



The marking of the highest flood levels should be done thus:—

H. F. L.
8—1924.

The line marking the level of the highest flood should be in black, 1 inch broad and 12 inches long, and the letters "H. F. L." above the line and the figures below the line should be 4 inches deep.

In addition to these records, there will be in future two books for recording bridge repairs and damages:—

(a) Bridge repairs register—

This is intended to record the annual inspection of and repairs to all bridges including those damaged by floods.

(b) The flood register—

This book is intended to record only observations in regard to floods and repairs to the bridges damaged by floods. These records will form a continuous history of the bridges.

All records must be completed by the end of the rains and the book produced at the Annual Inspection,

Soundings must be taken at bridges of the rivers shown in the attached list during April and again immediately after the rains, during October and November. These soundings are to be taken on the centre line of the bridge 100 feet above and 100 feet below the bridge. They shoud be plotted to a vertical scale of 20 feet to the inch; the horizontal scale should be according to the length of the bridge, but the plan should not exceed 10 feet in length. The sections referring to the dry season should reach this office before the end of May and those referring to the rainy season before the end of October

The sections of each season's soundings should shew the date on which the soundings were taken and should be in a colour different from the sections of previous seasons.

The Divisional Superintendents are requested to see that this order is carried out intelligently and regularly and that the required information reaches this office in time.

These orders supersede all previous orders on the subject of flood records.

Distance from Howrah Mileage.	Name of River.	Bridge No.	Span.	Main Line.	Branches.
5¾	Bally Khall	17	4×12′ 4×80′ Girders	Main Line.	......
27¼	atgnon Bridge	94	15×28′ G 14×28′ G 2×11′–3″ G 3×78′–6″ G	„	......
64¾	Bunka Nalla Bridge.	209	4×80′ G	„	......
125¼	Noonia River Bridge.	509	4×59′—0″ G 2×30′ G 2×30′ G	„	......
174½	Jainthee Nallah	603	12×42′—5″ G 2×84′—10″	„	......
186½	Pathroo Bridge	623	4×84′ G 8×40′ G	„	......
195½	Adjai Bridge	643	20×42′ G	„	......
261¼	Kiul Bridge	186	9×150′ G	„	......
266½	Hullohur Bridge	152	4×150′ G	„	......
359⅝	Lower Sone Bridge	200¼	28×150′ G	„	......
419¾	Karmnasa Bridge	371	13×40′ A 3×38′ G	„	......
492¼	Tonse Bridge	5	7×150′ G 2×32′ G	„	......
510½	Jumna Bridge	30	14×200′ G 2×29′ G 1×29′—4″ A 2×30′ 19×30′	„	......
26	Jubilee Bridge (Ganges.)	8	1×420′ 1×360′ 1×420′ 1×149′ 16×10′—10″	......	Naibati Branch.
91½	Adjai Bridge	167	10×60′ G	...	Bandel Barharwa. Loop Line.
95¼	Ditto	56	32×50′ G	...	„
102	Kopai Bridge	77	12×60′ G	..	„
107¼	Bakeshwar Bridge	89	12×60′ G	...	„
119	More Bridge	123	24×50′ G	...	„
143¼	......	172	9×60′ G 7×30′ G	......	„
143	Barakar Bridge	18	1×200′ 5×150′ 6×100′ 5×3′ A	......	Grand Chord.
290½	Phalgu	345	1×30′ G	..	„
335¾	Poon Poon	509	8×60′ G 18×100′ G	......	„
343	Upper Sone Bridge.	531	93×100′ G	......	„
369½	Soma Bridge	29	30×30′ G 3×60′ G 4×10′	......	South Behar.
300	Sakri Bridge	148	16×60′ G	......	„

Distance from Howrah Mileage.	Name of River.	Bridge No	Span.	Main Line.	Branches.
305¾	Khuri Bridge ...	179	14 × 60′ G ...	......	South Behar.
322⅛	Dhadar Bridge ...	268	12 × 60′ G ..	... ..	"
345½	Poon Poon Bridge	21	2 × 52′—6″ G ... 5 × 50′ G ...	}	P. G. Branch.
414½	Amanat Bridge ...	253	7 × 100′ G ...	......	Barun Daltonganj.
789¾	Strachey Bridge ...	22	9 × 154′ G ...	... ..	Agra Branch.
799¾	Bridge over Kali Nadi.	136	10 × 60′ G ...	......	S. F. Branch.
Distance from Moghal Sarai.				O. & R. Sec.	
6⅝	Dufferin Bridge ...	... ..	7 × 333′ G ... 18 × 50′ G ..	} Main Line.	... ..
91½	Sai Bridge ...	... .	4 × 100′ G ...	" ...	......
208½	Khanant Bridge ...	......	10 × 60′ G ...	" . .	......
302¾	Gurrah River ...	... ..	18 × 60′ G ...	" ..	... ..
357	Byghool Bridge ...	......	7 × 100′ G ...	" ..	......
359¾	Bhukra Bridge ...	. ...	6 × 100′ G ...	" ..	.. ...
385½	Kosi Bridge ...	... .	10 × 100′ G ..	" .	....
397	Ramganga Bridge	......	10 × 200′ G ...	" ..	......
470¾	Malin River ...	......	5 × 100′ G ..	" ..	......
477	Ganges Bridge Balawali.	......	11 × 250′ G ..	" ..	......
482	Ramganga Bsidge	.. ...	10 × 84′ G . 14 × 84′ G ...	} " .	... ..
490½	Solani Bridge ...	......	16 × 71′ G ...	" ...	......
515¾	Hindun Bridge ...	......	5 × 100′ .	" ..	......
36½	Sai Bridge ...	......	18 × 56′ G ..	......	Benares Fyzabad Loop.
44½	Goomti Bridge ...	......	16 × 82′ G ..	......	"
93½	Tonse Bridge ...	......	12 × 60′ G ...	......	"
24½	Sa Bridge ...	......	8 × 84′—6″ G ... 4 × 61′—6″ G ... 2 × 20′ G ...	}	Janghai Phaphamau.
Distance from Allahabad.					
7	Curzon Bridge ...	......	15 × 200′ G ...	......	Allahabad and Phaphamau.
62	Bridge over Goomti.	......	6 × 100′ G ...	... ..	Partabgarh and Fyzabad.
Distance from Lucknow.					
42½	Cawnpore Bridge	......	25 × 100′ G .. 1 × 40′ G ...	}	Lucknow-Cawnpore.
Distance from Bareilly.					
4½	Ramganga Bridge	......	1 × 72′ G ... 33 × 56′ G ...	}	Chandausi-Bareilly.
72½	Ganges Bridge Rajghat.	......	33 × 80′ G ...	......	Moradabad to Aligarh
Distance from Moradabad.					
2½	Gangan Bridge ..	......	10 × 60′ G ..	......	Moradabad to Aligarh.
41½	Ganges Bridge ...	... ..	11 × 200′ G ..	......	Hapur to Moradabad.

B.—Erection of Steel Bridges.

184. Engineers, Inspectors and Contractors are expected to make themselves thoroughly familiar with the general and special specifications governing the work.

185. All material received must be neatly laid out, carefully checked, recorded and reported upon immediately it is received. Shortages should be reported immediately. Material received should be checked against complete bill of material, and every effort made to avoid delay to the progress of the work by failure to receive material, including false work, plant, tools, etc., etc.

186. In the case of important bridges the Engineer in charge shall keep an accurate record of the cost of the work, including material and labour, keeping separately each class of work, such as unloading, repairing, raising, fitting, rivetting, cleaning, painting, framing, bolting, contractors' pay roll, character of plant, framing and erecting false work, and removal of same. A diary must be kept containing dates of commencing and completing different classes of work, and all other general information of value. This information should be embodied in a history of the work to be sent to the Chief Engineer for record on the completion of the work.

187. The Engineer in charge must check all distances and elevations on plans before laying out the work, and will be held responsible for any errors that may arise, through neglect on the part of himself or assistants to verify properly and re-check plans, points and elevations given for the erection of the structure. Distances between centres and elevations of finished tops of masonry are specially important, and should be re-checked as often as may be necessary in order to absolutely insure against errors. The sum of the heights of the component parts forming the structure should be carefully checked against the total finished height above assumed datum to rail level. The sum of all detail lengths must also be checked, with equal care, against the total length from the fixed initial point.

188. It must be seen that the material is not injured, or dangerously strained during the operation of loading, unloading or handling. All defects in workmanship or material must be remedied as soon as detected. A thorough inspection must be made of the material on receipt for defects in painting, cleaning, reaming, burrs, sharp edges, etc. All such defects shall be remedied immediately, and noted in detail, to provide full information, in case of claims for compensation.

189. Slight bends in members shall not be straightened unless strictly necessary, on account of the danger of over-straining connections and rivets. Plates and bars if slightly bent or twisted, shall be straightened cold if possible; if bent so sharply as to require heating, the whole piece thus heated shall be subsequently annealed All shop rivets, or any piece or member thus straightened, shall be properly tested. All cold straightening must be by pressure only.

190. Particular care should be taken to insure free expansion and contraction wherever provided for. Any departure in dimensions, amount of camber, etc., of material received, from plans and specifications must be noted and reported immediately.

191. All machine fitted bolts shall be perfectly tight, and the ends should be burred or otherwise checked, to prevent nuts from becoming loose. No unfilled rivet or bolt holes should be left in any part of the structure.

192. The material shall be assembled in accordance with the erection marks, and no interchange of pieces shall be made, unless absolutely necessary in order to avoid chipping and fitting, or serious delay, or unless interchangeable girder work has been supplied.

193. Fitting and riveting of connections (especially angles) in cases where pieces are short or full, shall be done in such a manner that the metal is not unduly strained, or cracks caused.

194. Dishonest or incompetent workmen frequently fill cracks with paint, putty, cinders, dirt, oil or filings, for the purpose of deception. A close inspection must be made for this.

195. Wooden rams or malls shall be used in forcing members into position, in order to protect the metal from injury or shocks.

196. Chipping of rivets, angle flanges and edges of plates must be done without breaking out metal. Chipped edges shall be finished off with a file, and all concave corners shall be rounded off. Chipping with a sledge shall only be permitted in exceptional cases, and must be done without leaving fractured edges.

197. In driving rivets the dolly and die should be placed directly opposite each other at right angles to the riveted surface to insure straight driving. Rivets shall be driven while at a straw heat, and no burnt rivets should be used. The ragged edge round the head shall be neatly chipped off.

198. After riveting each rivet shall be tested with a hammer to insure that they are tight, and the heads must be well formed, concentric with centre of rivet, and closely fitted against the riveted surface.

199. Defective rivets can usually be detected by their colour or by sound when tapped with a hammer or by placing a finger against one end and tapping the other end with a hammer and all loose or burnt rivets must be immediately cut out and replaced.

200. In cutting out rivets be careful to ascertain that other rivets in proximity have not been loosened.

201. Countersunk rivets must be inspected after chipping heads, and no unnecessary chipping should be permitted.

202. Where two surfaces are in contact, each surface is to be cleaned and given one coat of red lead paint before the two surfaces are riveted together.

203. When a bridge of small spans is on a curve the necessary superelevation of the outer rail, should be given on the bed stones which should be provided and set so as to give the necessary cant to the span as a whole

CHAPTER XII.

LEVEL CROSSINGS.

Read General Rules for Indian State Railways paras. 48 and 350 to 358.

204. The attention of all Engineers is drawn to the General Rules 350 to 358 which govern the control of Level Crossing Gates. It is common knowledge that these rules have not always been strictly observed in the past, but it should be distinctly understood that they express the definite orders of the Railway Board and no deviation from them can on any account be condoned. The most important and fundamental principle is that laid down in General Rule 352, Section (4), *viz.*, that

> " **Unless otherwise directed by special instruc-**
> "**tions** all gates at Level Crossings must be kept open
> "for the passage of trains and securely fastened across
> "the thoroughfare, and shall only be closed to the passage
> "of trains when it is necessary to open them for the
> "passage of road traffic."

From this it is clear that the normal position of all Level Crossing Gates is closed to road traffic and although it is not our practice to have gates closing to the passage of trains the intention is obvious that they are only to be opened when necessary for the passage of road vehicles and of course only when the line is clear.

The reservation "unless otherwise directed by special instructions" is obviously intended to provide for exceptional cases such as Level Crossings in towns or congested areas where the road traffic is heavy and practically continuous, but there should be no generalization in issuing special instructions. Each case must be carefully considered on its own merits and any special instructions which may be necessary should be issued by the Divisional Superintendent and a copy posted at the Gate-lodge as is done with the Duty Sheet of Gate-keepers.

Gates cannot be considered as "securely fastened" unless it is impossible for them to be opened by any unauthorized person, and the most effectual method of fastening is by means of a padlock through a hasp on the bolt of the gate. The locking bolts of all gates and the padlocking arrangements should be inside, *i. e.*, on the side of the gate nearest the line. It is the duty of Assistant Engineers to satisfy themselves by personal inspection that all Gate-keepers are provided with locks and properly fitting keys in good condition, and a certificate should be submitted quarterly to the effect that the equipment at every Level Crossing Gate is complete and in good order—locks, keys, flags, fog signals, hand signal lamps, an adequate supply of oil, matches, rule-book and a tommy-bar for cleaning the channels between rails and check-rails. Also at important Level Crossings—2 gate-lamps, with red and white lenses.

The Assistant Engineer should also satisfy himself that all lamps are kept clean and in a condition to ensure them showing a good light.

Level Crossings on public roads crossed by a Railway will be classed as A, B and C:—

"A" class crossings will ordinarily be provided on main roads.

"B" class crossings will be provided on less important roads.

"C" class crossings will be provided on country tracks.

The class of crossing to be provided in each case "A", "B", "C" or special will be fixed by the Local Authority concerned.

The standards to be observed at the various classes of crossings are as detailed below and estimates should be submitted for bringing all crossings up to these standards.

For "A" class crossings:—

(*a*) Guard rails 30 feet long. The crossing between the rails and up to the end of the "Level" portion will be metalled to a width of 16 feet. The metalling of the remainder of the crossing will conform throughout to the standard on the road.

The thickness of metal after consolidation must not be less than 6 inches and a soling of boulders 9 inches thick will be provided.

(*b*) Gates with posts giving a clear opening of 16 feet, when gates are open.

(*c*) The gradient of the road will be "Level" for 50 feet on either side of the centre line of the Railway. Where there is more than one line at the level-crossing, the road will be level for not less than 30 feet from the centre of each outside track.

(*d*) The gradient of the approach will ordinarily be 1 in 30, but it the provision of such a gradient brings the foot of the graded approach outside the Railway boundary, or if there are any other features of the case which appear to call for special consideration in the matter of grading the case will form the subject of special arrangement between the Local Authority concerned and the Railway.

(*e*) Each crossing will be provided with 2 gate-keepers and two gate-lodges or double gate lodge and each gate-keeper will be on duty for a period of 12 hours.

For "B" class crossings:—

(*a*) Guard rails 20 feet long. The crossing between the rails and up to the end of the "Level" portion will be metalled to a width of 12 feet. The metalling of the remainder of the crossing will conform throughout to the standard of the road.

The thickness of metal when consolidated will not be less than 6 inches, and a soling of boulders and muram 9 inches in thickness will be provided.

(*b*) Gates with posts giving a clear opening of 12 feet.

(*c*) The gradient of the road will be level for 50 feet on either side of the centre line of the Railway Where there is more than one line at the level-crossing, the road will be level for not less than 30 feet from the centre of each out-side track.

(*d*) The gradient of the approach will ordinarily be 1 in 30, but if the provision of such a gradient brings the foot of the graded approach outside the Railway boundary, or if there are any other features of the case which appear to call for special consideration in the matter of grading, the case will form the subject of special arrangement between the Local Authority concerned and the Railway.

(*e*) Each crossing will be provided with a gate-keeper and a gate-lodge. The gate-keeper will be on duty from sunrise to sunset, and must remain in the gate lodge from sunset to sunrise to open the gates if called upon to do so for the passage of road traffic.

For "C" class crossings :—

The same as for "B" class with the following exceptions :—

(*a*) Guard rails will be 12 feet in length. The crossing between the rails and up to the end of the "Level" portion will be metalled to a width of 9 feet.

(*b*) The road will be level for a length of 30 feet on either side of the centre line of the Railway, or where there is more than one line of rails at the crossing, from the centre line of the outside pair of rails.

(*c*) The gradient in the approaches is not to be steeper than 1 in 16.

(*d*) Gates, gate-keepers and gate-lodges will not be provided.

At important crossings near a Railway station where the road gates are interlocked with the station signals, wicket gates will be provided for pedestrians.

(*a*) The incidence of the cost of new level-crossings or of alterations to existing level-crossings shall be determined under the provisions of the Indian Railways Act, 1890.

(*b*) All works within the Railway boundary shall be carried out by the Railway.

(*c*) All works outside the Railway boundary shall, as a rule, be carried out by the Local Authorities concerned, but may, if desired by mutual agreement, be carried out by the Railway.

(*d*) The approval of the Railway to an estimate prepared by the Local Authorities concerned Department, is necessary if the work is to be carried out, or paid for, by the Railway, and *vice versa.*

The Railway authorities shall be responsible for the maintenance of the road between their normal boundary line; that is to say, that if a long diversion of an existing road is made to obtain a better crossing, the Railway will construct the diversion and maintain it for two years, and after that hand it over to the Local Authority concerned in good order, reserving for maintenance only the length of the roadway equivalent to the normal side widths of land taken up by the Railway in the vicinity of the crossing.

No gateman is to be appointed unless he is physically fit to perform the duties required of him, and thoroughly understands these duties and the Permanent Way Inspector must certify to these points whenever a new man is appointed. All gatemen must be tested for eyesight before appointment and periodically thereafter as laid down.

If a gateman has to leave his gate lodge to go to a distance out of call, it is not sufficient for him to leave his wife or one of his family in charge, but he must arrange with the mate in charge of the length to provide a qualified substitute during his absence. The Permanent Way Inspector must see that he has qualified substitutes ready in case a gateman has to be relieved. When it is absolutely necessary for the gateman to leave the level crossing before a substitute can be provided, he must lock the gates and keep the keys in his possession.

Gateman must be instructed to water their level crossing in order to lay the dust immediately before mail and passenger trains are due to pass, and they should also be provided with a small stock of moorum or kunker and a durmush or rammer to enable them to keep the road surface in proper repair.

In any case when on account of a breakdown of a road vehicle or any other cause a gateman is unable to clear an obstruction from a level crossing he must place two fog signals on the line at a distance of eight telegraph posts, or as far as he has time to go, on either side of the level crossing and shew a danger signal to approaching trains.

No jungle should be allowed to grow in the vicinity of level crossings so as to obstruct the view either from the level crossing or from the gate-lodge, and it is the duty of the gateman to see to this.

Gate lamps at level crossings, and at A class level crossings the gateman's hand signal lamp, must be lighted immediately before sunset and not extinguished until sunrise.

Important Level Crossing gates should invariably be painted white and the paint kept scrupulously clean. Fairly frequent repainting of such gates will probably be necessary.

EAST INDIAN RAILWAY.

Engineering Department Manual.

CORRIGENDUM SLIP No. 18.

The last sub-para. to para. 204 of the Manual should read as follows :—

> "Less important level crossing gates should also be painted white."

CHIEF ENGINEER'S OFFICE, } G. S. ROBERTSON,
Calcutta, 21*st November* 1929. } *for Chief Engineer.*

W. O. No. 4832—1,500—26-11-29.

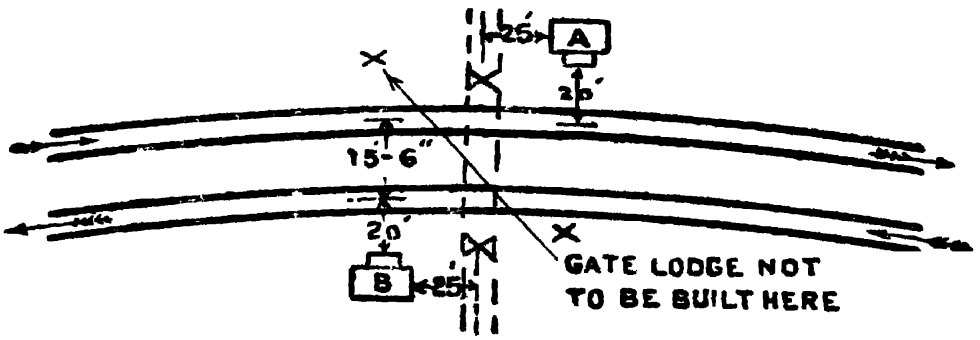
Less important level crossing gates (where there is no motor traffic) should be painted grey.

205. All gates at important level crossings should be provided with lamps showing red in both directions when the gates are closed for wheel and foot traffic. Green lenses should not be used in gate lamps as green lights are liable to be mistaken by drivers of trains for station signals or caution signals.

206. On road traffic offering at a level crossing the gate-keeper if the line is clear, should first open the gate furthest away from the road traffic so as to give that traffic an unimpeded passage over the crossing.

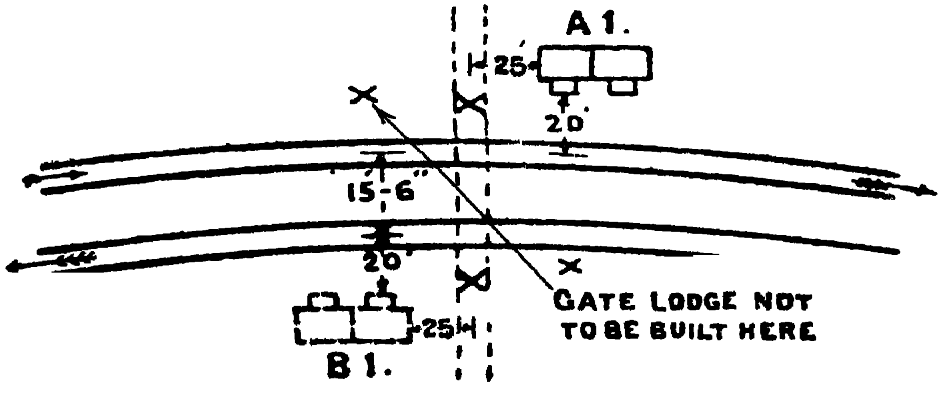
207. At all level crossings for double line or for line that may in future be doubled the gate lodge should be situated on the further side of the level crossing from the direction in which a train approaches on the nearer track so that an uninterrupted view may be had at the crossing of a train approaching on that track. If two gatelodges have to be constructed the second should be placed either diagonally opposite side of the line as in sketch (*i*) or as shown in sketch (*ii*) either A^1 or B^1 may be selected.

(*i*)



(*ii*)

SKETCH B.



208. On curves, the gatelodge, if only one is provided should be situated on the outside of the curve unless there is any special reason to the contrary, *i. e.*, site A should be preferred to site B.

209 The clearance between the running rail and the guard rail must never be less than two inches (standard gauge), 1¾ inches (Metre gauge), and may be more on curves. The guard rail at a level crossing is intended merely to protect the main rail and to maintain a space for the flange of the wheels but it should never be near enough for the flange of a wheel to touch or rub against it under any circumstances; its function is entirely different to that of a check rail at a crossing or on a sharp curve.

210. Gatemen should be warned to keep the running rails clean and free from earth, etc., and to clear out the space frequently between the running rail and the guard rails. This matter receives very little attention and on many level crossings dirt is allowed to accumulate in the channel until it fouls the flanges of wheels of trains and trollies.

211. Level crossings should invariably be opened out and the road examined, sleepers carefully packed and road levelled each time the gang goes through the road.

212. All gatelodges having one gateman should possess the following equipment.—

(*a*) 1 hand signal lamp
1 red hand signal flag
1 green hand signal flag
2 chains & padlocks or
2 padlocks only } for locking the gates
1 case containing 12 fog signals
1 tommy bar for cleaning the channels between rails.
1 kodali
1 durmush (required in the case of metalled road only)
1 bucket, pail or old iron drum
1 bottle for oil lamp
1 book of rules in the vernacular
~~1 Doz. metal brushes~~
Supply of matches and kerosine oil.

These quantities may be increased as necessary when there are two gatemen or more.

(*b*) In addition to the above at important non-interlocked level crossings.—
2 gatelamps with red and white lenses.

213. This equipment should be periodically inspected by the Assistant Engineer to see that it is in order. It should be examined by the Inspector at least once a month.

214. Where there are two or more gatemen at a level crossing their hours of duty should be definitely laid down and a notice should be affixed on the gatelodge stating the hours of duty of each man by name. Two sample forms showing the hours of duty of two gatemen are appended at pages 60 and 61.

EAST INDIAN RAILWAY.

Level Crossing No.________ **Miles** **T. P.**________

During the months of—

January
March
May
July
September
November

________son of________caste________
will be on duty at this gate from 6 oc'lock in the morning until noon and also from 6 o'clock in the evening until midnight.

________son of________caste________
wil be on duty at this gate from noon 6 o'clock in the evening and also from midnight until 6 o'clock in the morning.

फाटक न________तारीख________क्रैसिंग का नम्बर—

जनवरी
मार्च
मइ
जुलाइ
सेप्टेम्बर
नवेम्बर महिना मे

________का लड़का________जात________
फाटक पर रहेगा ६ बजे भोर से दिन दो पहर तक और फेर ६ बजे शाम से दो पहर रात तक ।

________का लड़का________जात________
फाटक पर रहेगा दीन दो पहर से ६ बजे शाम तक और फिर दो पहर से ६ बजे भोर तक ।

By Order,

*Dated*________192 . *District Engineer.*
Supdt. Way & Works

EAST INDIAN RAILWAY.

Level Crossing No. ______ Mile ______ T. P. ______

During the months of—

February
April
June
August
October
December

______ son of ______ caste ______

will be on duty at this gate from 6 o'clock in the morning until noon and also from 6 o'clock in the evening until midnight.

______ son of ______ caste ______

will be on duty at this gate from noon to 6 o'clock in the evening and also from midnight until 6 o'clock in the morning.

फाटक नं॰ ______ माइल ______ टेलिग्राफ का खम्भा ______

फरवरी
अप्रैल
जून
अगस्त
अक्टूबर
दिसम्बर महीनों में

______ का लड़का ______ जात ______

फाटक पर सबेरे ६ बजे से दोपहर तक और साँझ के ६ बजे से आधी रात तक रहेगा ।

______ का लड़का ______ जात ______

फाटक पर दुपहर से साँझ के ६ बजे तक और फिर रात की दुपहर से ६ बजे भोर तक रहेगा ।

By Order,

D______ ______ 189

District Engineer,
Supdt. Way & Works.

EAST INDIAN RAILWAY.

Manual for Engineering Department.

Corrigendum Slip No. 4.

Page 61. In para. 215a —Item 19—*Read* "Lamp hand signal ... ... 2" *instead of* "Lamp hand signal ... ... 1."

CALCUTTA,
Dated the 18*th* *Oct*. 1928.

Chief Engineer.

Regt. No. 3113—1,500—19-10-28.

CHAPTER XIII.

MAINTENANCE OF PERMANENT WAY.

Gang tools.

215. The permanent way is the first and most important charge of the Engineering Department, and requires the most minute, constant and unflagging attention. The increasing speed of trains and the increasing loads necessitate more and more care and Assistant Engineers and their staff should take a pride in the production and maintenance of a good and smooth running track.

215 (*a*) List of Tools and Plant with ordinary Main Line Gang of 1 mate, 1 keyman and 8 men:—

	Description.	No.	REMARKS.
1	Adzes Carpenter	1	
2	Augers screw of sizes	4	
3	Axes	1	
4	Beaters rail	8	
5	Billhooks or Dah	2	
6	Boards inch cut...	1	
7	Books Regulation	1	
8	Basket cane	6	
9	Chisel cold	1	
10	Cold set or Rail cutter	1	
11	Crowbars	7	
12	Drift steel D/O.	2	
13	Flags of sorts	2	
14	Fog signal	1	Dozen.
15	Gauges rail	1	
16	Hammer hand	1	
17	„ keying	2	
18	„ spiking	1	
19	Lamp ~~hand~~ band signal	2 ~~1~~	
20	Level spirit	1	
21	Muster roll tin	1	
22	Padlock	1	
23	Phowrah	8	
24	Pick axes	2	
25	Rail straightener or Jim Crow	1	
26	Rod measuring teak	1	
27	Rakes ballast	4	
28	Spanner plain	4	
29	Spikes drawer	1	
30	Sickles	4	
31	Square plain	1	
32	Straight edge wooden	1	
33	Tongs smith	1	

215 (*b*). **List of tools and Plant with Yard Gang of 20 men working on points and crossings, etc., 1 mate, 1 keyman, 18 men:—**

	Description.	No.	Remarks.
1	Adzes Carpenter	1	
2	Augers screw of sizes	6	
3	Axes	2	
4	Beaters rail	18	
5	Billhooks or Dah	1	
6	Boards inch cut	1	
7	Books Regulation	1	
8	Buckets G. I.	1	
9	Baskets cane	12	
10	Banners red	1	
11	Chisel cold	1	
12	Cold set or rail cutter	1	
13	Crowbars	14	
14	Drift steel D/O.	2	
15	Flags of sorts	2	
16	Fog signal	1	Dozen.
17	Gauges rail	1	
18	Hammer hand	2	
19	„ keying	2	
20	„ spiking	2	
21	Lamp hand signal	1	
22	Level spirit	1	
23	Muster roll tin	1	
24	Padlock	1	
25	Phowrah	16	
26	Rails straightener or Jim crow	1	
27	Rakes ballast	4	
28	Rod measuring teak	1	
29	Spanner plain	4	
30	Spikes drawer or Pin cutter	2	
31	Sickles	4	
32	Square plain wooden	1	
33	Straight edges wooden	1	

Road over-hauling.

To maintain a good running road it is absolutely necessary that the road opening and adjustment should be done thoroughly and be carefully inspected before covering in.

(*a*) Road opening should be carried out completely on the main line and in all yards once a year.

(*b*) The road opening should commence as soon after the monsoon as possible and the work should be so mapped out that the whole section should be completed before the next monsoon.

It is not to be understood from the above that a portion of the road having once been attended to may remain untouched for the rest of the year. "Slacks" must be put right at once and rails hogged at the joint will require constant attention.

216. The actual overhauling of the track should be done in the following order:—

(1) The ballast must be removed by khodalies from between the sleepers and pulled well away. It is essential that the ballast between the sleepers be removed slightly below the bottom of the sleepers, so that the beater can be used more or less horizontally, thus ensuring the whole width of the sleeper being well packed.

If the ballast be entirely pulled away a low bundle of dirt and ballast will be discovered just outside the ends of the sleepers. This should either be removed entirely and the ballast screened and replaced or the ballast cut through at intervals of three sleepers to prevent waterlogging of the track.

(2) Broken iron sleepers and rotten wooden sleepers must be replaced as necessary.

(3) The sleepers must be respaced and squared to the rails where necessary.

(4) Screw spikes must be tightened up or dogspikes redriven. The gauge during this stage of the proceedings must be corrected.

(5) Old spike holes must be completely plugged with wooden plugs dipped in hot coaltar.

(6) The line should be straightened and roughly packed. The common practice of packing one end of a wooden or trough sleeper first and then packing the other end to the same level must be stopped. This causes the end first packed to be lifted off the ballast except at the extreme end, which is bad for the sleeper, and also for the *resulting running of the* track. It is necessary therefore to have two men packing at each end of a sleeper at the same time.

(7) The line should again be thoroughly packed, but the ballast not boxed in.

(8) The line should be left open for one day to allow bad joints to settle. On the following day any "slacks" that may have developed owing to faulty packing should be taken out and the ballast boxed in, the ballast being raked in (and not packed in by khodalies) so as to free it from dirt as much as possible. No boxing in of the ballast is to be done until the packing has been passed personally by the Permanent Way Inspector.

218. On the East Indian Railway there are the following general types of permanent way.

Types of rails

(*a*) Double headed and bull headed rails laid with chairs on wooden sleepers.

(*b*) Double headed and bull headed rails laid on D. O. sleepers.

(*c*) Flat footed rails laid with bearing plates on wooden sleepers.

(*d*) Flat footed rails laid direct on wooden sleepers.

(*e*) Flat footed rails laid on Fowler Box cast iron sleepers, on Lines cast iron sleepers or on others.

(*f*) Bull headed rails or flat footed rails laid on various experimental patterns of ferro concrete sleepers.

Future section.

218-A. In future only two sections of rails will be obtained for use on the East Indian Railway:—

(*a*) On lines classed as Heavy Mineral 115-U. F. F. B.S. rails will be used.

(*b*) On other lines 90 lbs. F. F. B. S. rails.

All new points and crossings will be made from one of these sections.

When the rails are used on wooden sleepers rail screws will be used on the section below Moghalserai, dog spikes being used above Moghalserai Bearing plates will be used on soft wood sleepers only.

219. The rail forms the most important part of the permanent way. It is the part on which depends most of the smooth running of traffic and on the rail therefore the greatest possible care should be bestowed. It has already been pointed out that the Inspector should attend particularly to the handling of new rails and the same attention should be shown to them both before and after they are laid in the road.

220. In the chapter on Relaying the procedure to be adopted with regard to new rails has been laid down.

221. The proper maintenance of new rails depends upon the fittings being in good order, the sleepers being adequate maintenance of new rails the ballast being sufficient and the formation being firm. Assuming that all these factors exist good maintenance may suffer from:—

(*a*) Proper expansion not having been allowed.

(*b*) the joints not being properly fished.

(*c*) the sleepers being unequally spaced.

(*d*) the gauge and cross levels being incorrect.

(*e*) the rails being kinked.

(*f*) the line not being properly packed.

Pulling back.

222. The proper expansion for rails has been given in the chapter on Relaying. The expansion has to be corrected from time to time, as the rails under traffic have a tendency to draw away to one end and to jam there. The remedy for this is "pulling back." To certain indifferent Inspectors this process of "pulling back" is too much trouble and so as to allow room for further travel they content themselves with cutting off a portion of the rail at the end of the line (usually near the points of a station or at a level crossing) where the rails have jammed. This is strictly prohibited. Rails must be pulled back consistently from the point of commencement of travel or "creep" and carefully respaced. They must not be cut.

The operation of pulling back must be carried out by the Inspector in person or his Assistant and not left to the ordinary gangs. During the course of pulling back the line must be adequately protected in the manner described in the chapter on Relaying paras. 325 to 322 as for a work involving danger to traffic.

The Inspector must have with him during this operation an adequate supply of closures, so that on the approach of a train the gap in the line may be filled up and the train allowed to pass.

Pulling back involves the respacing of sleepers, especially the joint sleepers and this should be carefully done, the sleepers well packed up and all fittings tightened.

One of the dangers attached to this inadequate expansion is a "buckle." Buckles may be looked for when the hot weather first sets in and if at such times the joints at one end of a length are found wide and at the other end dead tight it is time to see whether these joints are not set fast and if so to slaken off every other joint.

Buckles.

Should a buckle occur the road should at once be protected by flags and detonators as laid down in paras. 322 and 323 and every other joint slacked off. No attempt should be made to straighten the road until this is done.

The road should never be opened out nor left open until this has first been attended to.

Inspectors are requested to instruct their men on these points beforehand instead of waiting until each gang has got up a buckle in order to learn how to avoid it.

Creeps devices

222 A. The following instructions when fitting creep chairs and anchors should be followed:—

1. *When both rails are creeping in the same direction*, as they generally do on a double line track which carries traffic in one direction only, anti-creep appliances should be fitted so that they, tend to force both ends of the same sleeper in the same direction.

2. *When the rails are creeping in opposite directions*, as they generelly do on a single line track which carries traffic in both directions, anti-creep appliances should be fitted so that only one end of any sleeper is called upon to check the creeping of the rails. It is not always possible to do this with thick anti-creep chairs which lift the rail some distance off the sleeper as the Fowler Box Jaw creep chairs do.

3. Creep anchor should be spaced as uniformly as possible throughout the rail length but should not be fitted to the joint sleepers or those next to them.

4. No creep anchors should be fitted on a girder bridge until all creep has been completely eliminated by fitting these appliances on the approaches on both sides of the bridge.

223. Given the correct expansion attention must be paid to the manner of applying the fishplates, so that they pull the rails into accurate alignment. Failure to secure accuracy of alignment, means uneven gauge at the joint, unequal wear at the ends of the two rails and uneven running of trains. It probably also leads to a twist in the rail and to ultimate hogging. On the other hand the inaccurate alignment may be due to one of the rails having got bent or twisted from careless handling. In any event the resulting bad running is the same.

In applying the fishplates to the rail the two inner bolts are at first to be inserted and these should be tightened only sufficiently to hold the rails in position, after which the two outer bolts should be inserted and tightened. The four bolts should then be evenly and thoroughly tightened up in order to secure the accurate alignment above referred to. When the bolts have been thoroughly tightened up they should be slackened off an eighth of a turn.

The handles of spanners to be used on fishbolts should not exceed, on standard gauge, 2′—0″ length and, on metre gauge, 1—3″ in length.

Joint sleepers

224. As the joint is the most important part of the rail so it is necessary that it should receive the greatest possible support. In no case should the centre to centre of joint sleepers exceed 2/3rd of spacing of intermediate sleeper spacing. All the other sleepers should be equally spaced throughout the length of the rail. Irregular spacing of sleepers indicates slovenliness on the part of the Inspector and it will usually be found that where sleepers are irregularly spaced they are also out of square and that therefore the line is out of gauge.

225. The gauge and cross levels will be dealt with in detail later. While it is very important that the gauge should be correct it is more important within limits that it should be uniform. The cross levels should also be accurate although there are still some Inspectors who favour the practice of keeping one rail a trifle higher than the other on the supposition that by throwing the weight of the engine on to the lower rail steadier and smoother running results. This practice should be discouraged and exactness on cross levels insisted on.

226. Reference has already been made to kinks in the rail. They cause a heavy lurch to the train which reacts on the permanent way and impairs the maintenance. Too much attention cannot be paid to the accurate alignment of the rails.

227. The packing of sleepers has already been touched upon and will be further dealt with later on.

228. When it is necessary to change an isolated rail a selected second hand rail only slightly worn should be put in place of the damaged rail. It is better to use such rails than to put a new rail in between old rails.

When one edge of the head of the rail is worn the other side may be turned end for end in its place or shifted to the other side of the track.

229. In many cases our old 75 lbs. D. H. steel rails are found to be hogged and otherwise defective at the joints. Where such defects are found to exist extensively in any section of the line, the rails may be turned in continuous lengths of not less than a quarter of a mile and preferably much longer—say between two stations. Sanction must be obtained from the Chief Engineer in every case before this is done. A careful record should be kept of all lengths which have been turned with the date of turning. A board is to be fixed a foot from the ground at each end of the turned length with the words "Rails turned" and the date, with an arrow to show on which side of the board the turned length is. **Hogged rails.**

230. All classes of broken rails must be specilaly reported to the Chief Engineer. In reporting these cases the following proceedure should be adopted:—

(a) The Divisional Engineers as soon as they come to know of a rail fracture should submit a report in the prescribed form annexed herewith. Separate return should be submitted for each section of rail and cause of fracture explained as indicated on the last column of the form. **Rail breakages.**

(b) In the case of rails which were under ten years in service the report should always accompany a 6 feet in length of the rail containing the fracture with the broken end duly protected from dirt and dust which would obliterate the original defects if any. A ferro illustrating the fracture should also accompany the report. The particulars of date, mileage, rolling marks, makers, cast number, etc., should be legibly painted on the fractured rail sent to this office.

APPENDIX.

Statement showing fractures of Steel Rails for the year ending 31st March 19 .

1	2	3	4	5	6	7	8	9	10	11
Description of rail.	Serial No.	Date on which fracture incurred.	Site (mileage and name of section or branch of the Railway.)	Probable total period the rail had been in the road (including previous use).	* Total length and actual weight per yard of broken rail.	Description of sleepers and number per rail length.	Distance from point of fracture to centre of sleepers on each side.	Maker's name and marks and year of manufacture.	Heaviest class of Engines in regular use on the section and heaviest Engine Axle load.	REMARKS. NOTE.—(1) In case of rails broken on curved track, radius of curvature should be entered in this column. (2) If the breakage was caused by an accident to a train or was due to any other special cause the fact should be mentioned in this column.
Ordinary rails—										
(a) On straight track ...										
(b) On curved track—										
(i) Outer rail of curve.										
(ii) Inner rail of curve.										
Special rails—										
(a) Stock rails ...										
(b) Switches ...										
(c) Wing rails										
(d) Point rails (nose of crossing.)										
(e) Splice rails (nose of crossing.)										

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* The actual weight per yard to be entered in column 6 should be obtained by dividing the actual weight of the broken rail in lbs. by its total length in yards.

(c) In the case of rails supplied from England found fractured on the line the same procedure as above should be followed except that a 12 feet length of rail instead of a 6 feet one should if possible be sent to this office with the report.

231. Rails which are worn or split at the ends may be cut and used as closures or check rails.

232. The ordinary length of fishplates used with 74 lbs. and 75 lbs. D. H. rails is 18″, 19″ and 22″, the holes on each side of the joint being 6″ apart centres and the spacing between these holes and the end holes being 4″ centre to centre. With wooden road by using a 22″ fishplates inside and a 19″ or 18″ fishplate outside and butting the chairs against the inside fishplate creep of rails may to some extent be stopped and at the same time the keys can be securely driven. There are also some 26″ fishplates with six holes still in the road. These should be removed and short fishplates substituted as opportunity offers.

233. It has been a common practice with some Inspectors when rails have got not only badly hogged but also badly worn on the underside of the head to heat the fishplates and bend them so that part of the fishplates bears more against the underside of the rail than the rest Apart from the fact that the heating of the fishplate in the hands of an Inspector who is not expert in heat treatments is most undesirable this bending of the fishplate is theoretically incorrect and as the fishplate now bears against the rail at only three points these points soon wear away and the result is worse than in the beginning. This practice is therefore prohibited.

234. Fishplates and bolts before being fixed to the rail should be coated with a special grease mixture consisting of:— **Greasing fishplates.**

Tallow	...	40 per cent.	3 lbs.
Castor oil	...	60 ,,	
Graphite	...	...	4 ,,

which mixture can be obtained from the Stores Department.

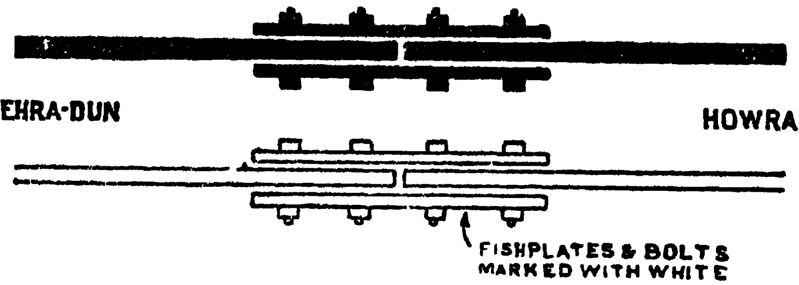
(1) All fishplates and fishbolts are to be treated with this special grease compound annually in February. In order to ensure that this shall be systematically done the following procedure is to be adopted.

(2) During one year therefore the fishplates and bolts painted white will be on the left hand rail looking

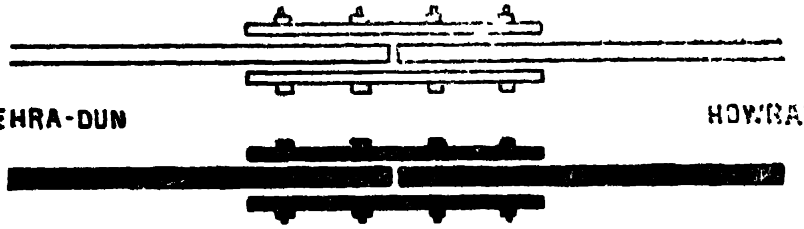
from Howrah while during the next ~~half~~ they will be on the right hand rail as per sketch below :—

Arrangement for one year.

When fishplates are removed for greasing the rail ends the fishplates should be thoroughly cleaned with a wir brush before being greased.



Arrangement for alternate years.



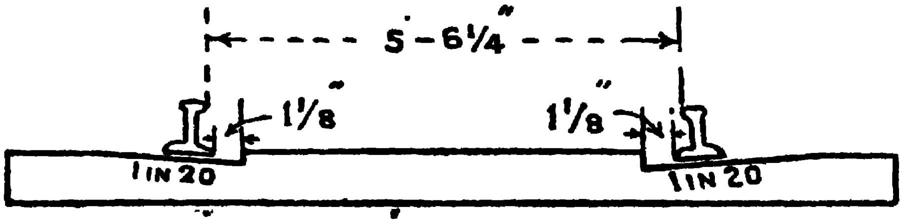
Wood sleepers.

235. The wooden sleepers commonly in use on the East Indian Railway are Central Provinces and Nepal Sâl, Deodar, Pynkado, Jharrah, Douglas Fir, Burmah Teak. There are also sleepers such as Chir, Thankyan and other varieties.

236. All wooden sleepers should be laid with the heart side undermost with the exception of Creosoted Douglas Fir sleepers. In Sâl, Jharrah and other Australian sleepers the medullary rays are numerous and if laid heart uppermost moisture penetrates more easily into the sleepers and starts decay.

237. Where sleepers have a wind in them and have to be used with chairs or bearing plates the chair or bearing plate bed must be adzed or planed to ensure an even bearing, a template being used for the purpose. All chair and bearing plate beds are to be tarred with boiling coal tar. Picked sleepers should be used at the joints.

238. Where a rail is to be laid direct on a sleeper the sleeper will have to be adzed or planed as per sketch below. The dimension 5′-6¼″ is a general dimension given for the purpose of determining the extent of the adzing only and not for the sake of gauging regarding which see below :—



The slope of 1 in 20 should be accurately cut and carefully checked and the rail seat planed smooth and coaltarred.

The extra 1⅛ in. clearance at the inner foot of rails is :—

(1) to permit the head of the screw spike being screwed right down and so prevent any play of the rail between the timber and underside of head of screw spike.

(2) to prevent water lodging between the side of the foot of the rail and the timber, and so prevent rot from setting in.

239. On new unseasoned Nepal sâl sleepers rails on the straight and on curves of 2,865 feet and over should be laid $\frac{3}{32}$″ slack to gauge in the first instance. On new soft wood sleepers rails should be laid ⅛″ slack to gauge in the first instance. On seasoned sleepers whether these have been in the road or not it should not be necessary to allow any slack to gauge and they should be laid exact.

When the rails have taken their bearing the road on the straight and on curves of 2,865 feet (2°) and over should be exact to gauge. On curves of less radius the gauge is to be as follows :—

2,000 ft. radius	...	... 5′—6⅛″.
1,600 ft. ,,	...	... 5′—6¼″
1,200 ft. ,,	...	... 5′—6⅜″
860 ft. ,,	...	... 5′—6½″
800 ft. ,,	...	... 5′—6⅝″
685 ft. ,,	...	... 5′—6¾″

The necessary allowances ultimately to obtain this gauge on these curves should therefore be added to the amounts given in the previous para.

240. The shrinkage of different types of sleepers and their effect on the gauge is a subject to which Engineers and Inspectors might give useful attention. When new sleepers are put into the road the actual allowance made in the gauge should be carefully noted for future reference.

Patchwork renewals.

241. Patchwork renewals are not to be carried out with new wooden sleepers. All new wooden sleepers are to be laid in a continuous length, if possible in continuation of the last laid new wooden sleepers.

Patchwork renewals are to be carried out with serviceable sleepers recovered from the line when continuous renewals with new wooden sleepers are carried out. These sleepers should be of the same type as those to be taken out and if possible of the same age. Soft wood sleepers should not be mixed up with hard wood sleepers.

In carrying out patchwork renewals it should be borne in mind that the correctness of the gauge is not so important as the uniformity.

Bridge sleepers.

242. All bridge sleepers are 9′ × 10″ × 7″ standard. Bridge sleepers on standard and metre gauge should be at least one foot longer than the distance from outside to outside of girders.

(*a*) On standard gauge they should be 10 inches wide with a minimum depth of 6 inches after notching and spaced at not more than 2 ft. 6 ins. centres. On metre gauge they should be 8 inches wide with a minimum depth of 5 inches after notching and spaced at not more than 1 ft. 6 ins. centres. See Standard Dimensions.

243. The ends of all bridge and crossing sleepers should be bolted with a $\frac{5}{8}$″ bolt with washers 3 inches diameter at either end.

(*a*) As an alternative S brand clamps can be used instead of bolts.

244. All bridge timbers should be coal tarred at least once a year The portion where the sleeper has been cut for notching and the portion where it bears on the girder should be given two coats of coal tar before it is laid on the girder.

245. In future on all girder bridges hardwood sleepers with bearing plates and flat footed rails should be used.

246. It is desirable too that the approach rails to girder bridge should be of the same section as those actually laid on the bridge and laid on wooden sleepers.

247. Thin packing pieces of timber are not to be allowed between girders and sleepers, under rails or under bearing plates.

248. Wherever possible bridge sleepers are to be bolted to the girders with four holding down or hookbolts, two being outside and two inside. The holes for the hookbolts should, if possible, be bored from the underside of the sleeper to ensure the hookbolts fitting close to the girder flange and so prevent the sleeper from shifting laterally once it is fixed in place. The washers should not be less than three inches square and one quarter of an inch thick. The holding down or hookbolts should be tarred all over before being put in place. Where holes have been provided in the girders for the holding down bolts these must of course be used.

249. The practice of using four hookbolts cannot be followed when bridge chairs are used.

250. The underside of each bridge chair where bridge chairs are used and the top surface of the bridge sleeper where the chair rests are to be tarred after the holes are bored.

Dating of sleepers.

251. New sleepers when placed in the road in renewals should be marked with the year in which they are laid. The figures should be 2½ inches high and should be neatly chisel cut. The figures should be first marked off from stencil plates They should be cut on the upper side of the sleeper and midway between the rails, and should all face in the one direction, of the traffic.

(*a*) Unless the middle of the sleepers is covered by planks to form a footpath when the figures should be cut on a visible part of the surface of the sleeper.

252. In renewing sleepers, whether wooden or other kind, without removing the rails or absolutely blocking the line no two adjacent sleepers may be taken out at the same time nor may more than three sleepers to each pair of rails be taken out at the same time. Care must also be taken to have the new ones in place and well packed before a train is due.

253. In packing under wooden sleepers only the portions 16 ins. (in the case of the standard gauge) and 12″ (in the case of the metre gauge) on each side of the rails should be packed hard the rest being loosely packed to form a grip on the sleeper.

254. Old sleepers taken out of the road must not be left lying about the line, but must be stacked at the nearest ganghut or gatelodge When a ballast train is available they are to be removed to the nearest depôt or convenient station until the Engineer responsible can arrange for their disposal.

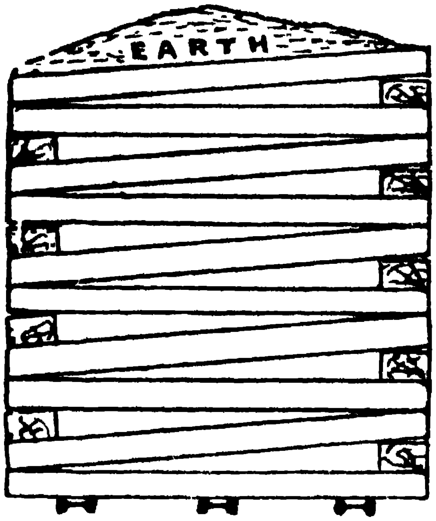
Stacking sleepers

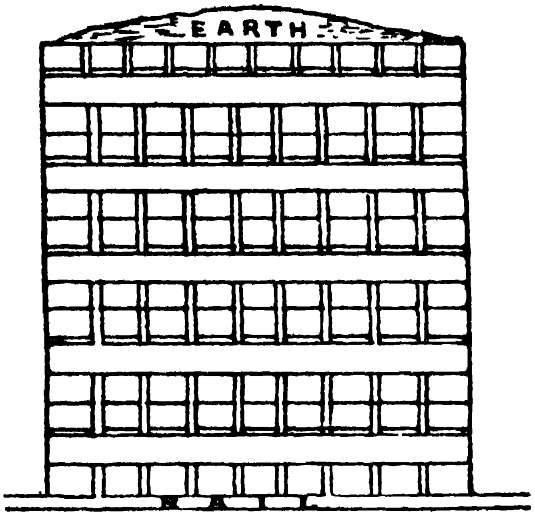
255. When new sleepers are received by any Inspector they should be carefully stacked in accordance with the following instructions. The stacking ground should be dressed to a uniform slope as, if the ground is uneven, the sleepers will, if left any time in the stacks, get a permanent bend or twist which, especially with long ones, makes them unfit for use in the road. It is preferable to dress the ground to a slope so that the water will run off during rain.

The sleepers when stacked in lots of 100 should be covered up with earth to protect them from the sun, as much of the timber, which we get nowadays is freshly cut and the sleepers will split if directly exposed at first to a hot sun. Each sleeper should be laid on the stack with its heart side downwards—as it should usually be laid in the road—and besides covering the top layer with earth the sides and ends of the sleepers on the outside of the stacks where exposed to the sun should be thickly smeared with wet earth.

The sleepers should be stacked an inch or two apart in each course and as large a surface as possible of each sleeper should be exposed to the air so as to facilitate drying and seasoning.

A diagram showing the proper method of stacking the sleepers is given below :—





256. Special care should be taken with long sleepers, as they are very expensive besides being difficult to get.

257. Stacks of sleepers at the side of the line should be clear of all grass, and should be covered with a layer of earth. Special precautions against fire should be taken with sleeper stacks used as temporary supports to girders, or for other such purposes. Their upper surfaces should be covered with corrugated sheets or protected in any other way that may be feasible. Where practicable the inside of the stack should be filled with earth or sand.

258. To prolong the life of Jharrah sleepers they should be carefully protected from the sun for 2 or 3 months after being landed, otherwise they will split. The after behaviour of Jharrah solely depends upon the care taken to protect it from the sun when first landed and experience has shown that when this is done the results are satisfactory.

EAST INDIAN RAILWAY.

Engineering Department Manual.

Corrigendum Slip No. 17.

In supersession of item (5) of Addenda and Corrigenda Slip No. 5, dated 5th December 1928, para. 262, in page 77, should read as follows :—

"The following should be adopted as the standard sizes of augers to be used in boring holes in Sâl and Deodar and other soft wood sleepers for Dog-Spikes and Rail Screws :—

Description of Sleepers.	For 5/8" Dog Spikes.	For Rail Screws and Screw Spikes.	
		13/16"	¾"
Sâl sleepers ...	9/16"	11/16"	11/16"
Deodar, Chir and other soft wood sleepers.	½"	5/8"	5/8"

Chief Engineer's Office, } A. C. DUNSDON,
Calcutta Dated, the 27th September 1929. } *for Chief Engineer.*

W. O. No.—2983—1,500—3-10-29.

259. Jharrah sleepers should be distributed in covered goods wagons to the nearest station where they are required and stacked there, the stacks being covered with earth. Care should be taken to remove from the stacks and truck out only such quantities as can be inserted in the line at once. No sleepers should be left lying in the sun. Jharrah and other hardwood sleepers from Australia are not to be bound at ends in future, but they must be stacked and protected in the manner prescribed above with as little delay as possible.

260. The holes for rail screws and chair spikes should be bored right through the sleeper, care being taken to hold the auger perfectly vertical.

Boring sleepers.

261. It will tend to increase the life of a sleeper if the hole after being bored is given a coating of boiling coal tar. In a Douglas Fir sleeper the protective creosote penetrates only a small distance below the surface and in boring holes through this surface we open up unprotected portions of the sleeper which then become liable to decay.

262. A ⅝" diameter auger is to be ordinarily used for boring holes for ⅝" rail screws and ⅝" square dog spikes and ¾" chair spikes.

Spikes rail screws augers.

(*a*) The tipsof the augers should be frequently dipped in oil to prevent their being broken—

263. Rail screws and spikes should be dipped in coal tar or oil before being screwed in. Rail Screws will require a slight tap with a hammer to give them a start before screwing in. Care should be taken not to overscrew as this may tend to bend the rail screw. When plain spikes are being driven in a proper spiking hammer, and not a keying hammer, is to be used.

264. Rail screws and dog spikes are to be used as under:—

(*a*) Without bearing plates 4 per rail seat at joints, 2 per rail seat at intermediate sleepers except on curves where intermediates should have 3 spikes, 2 outside and one inside on the outside rail only.

(*b*) With bearing plates 4 per rail seat at joints, 3 per rail seat on intermediate sleepers, 2 outside and 1 inside. This applies also to bridge sleepers used to Douglas fir sleepers even when used without bearing plates.

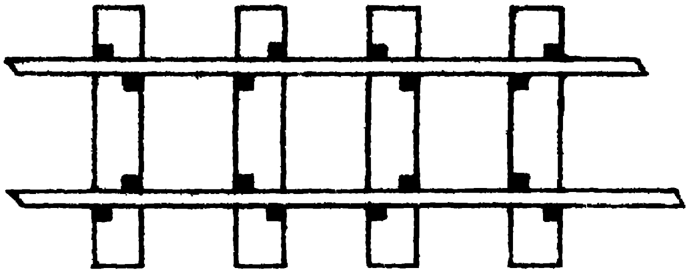
EAST INDIAN RAILWAY.

Engineering Department Manual.

CORRIGENDUM SLIP No. 7.

Delete **para. 264 (C), page 78 and sketch therein and** *substitute*—

(C) " When two rail screws or dog spikes only are used they should be driven as shewn in sketch below " :—

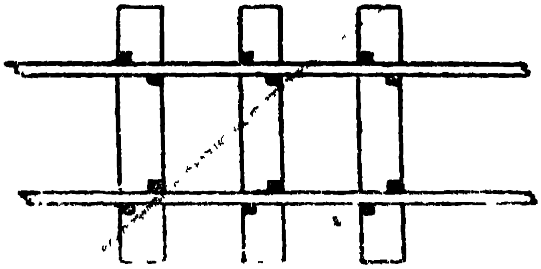


CHIEF ENGINEER'S OFFICE,
***Calcutta*, 19*th April* 1929.**

A. C. DUNSDON,
for Chief Engineer.

W. O. No. 392—1,500—28-5-29.

(c) When two rail screws or dog spikes only are used the two outer should be in one line on one side of the centre line of the sleeper and the two inner in one line on the other side of the centre line of the sleeper – see sketch : —



265. Screws or spikes must not be drawn unless absolutely necessary for regauging. Every time one is withdrawn it enlarges the hole in the sleeper and the latter thereby loses part of its holding power.

266. Old spike holes should be filled up with wooden plugs made from old sleepers, the plugs being tarred before being driven. Care should be taken that the plug fills the hole, otherwise moisture may still penetrate to the cavity and decay may continue. This is an important matter and must be personally attended to by Permanent Way Inspectors.

267. When chairs are used (either three holed or four holed) only two spikes per chair should be used.

268. Standard chairs are made right and left with an arrow mark to show the way to drive the key.

(a) On double line the keys should be driven with the traffic except beyond the joint where they must face it in order to get the joint sleeper close up.

(b) On single line the keys of alternate sleepers should face different ways.

As D. O. plates are not handed the keys on each sleeper must face different ways.

269. Old narrow base chairs are obsolete and should never be replaced on the main line once they have been taken out. They should be returned to Stores and not allowed to accumulate.

Ballast. **270.** The condition of the ballast is an important matter. In Standard Dimensions it is recommended that the depth of ballast below sleepers shall be 8 inches. On the main lines of this Railway it is usual to allow 2′-0″ from top of rail to top of formation, which gives 1′-0″ of ballast below wooden sleepers. The greater depth of ballast gives a better cushioning effect and helps the maintenance. The ballast, however, must not be allowed to become consolidated, otherwise the cushioning effect is lost.

The cess must not be higher than formation under track and must be kept clear of the jungle.

271. Ballast must be kept clean. Dirty ballast leads to decay in sleepers either from rot or from white ants.

Lift to the track.

272. In lifting permanent way no lift must be greater than three inches, and then it must be effected in a length of at least 60 ft. in such a manner as not to occasion any sudden change of gradients; when both rails have to be lifted they must be raised equally and at the same time, and the ascent must be made in the direction in which trains run, great care being taken where there is a curve to preserve the superelevation of the outer rail. Not more road than can be lifted in one day should be opened out and it should be boxed in as soon as possible.

Superelevation.

273. On the main line superelevation is to be given for a speed of 40 miles per hour, except on gradients where the track is double. It is clear that on gradients with a double track the speed is greater on one track than on the other. The speed to be provided for superelevation depends not only on the gradient, but on the section of the line on both sides. For each curve the Engineer should approximately ascertain what speed a train which travels at 40 miles an hour on the level would probably have on that curve (1) for Up trains and (2) for Down trains, and decide the superelevation accordingly, the full height being given at the beginning and end of each curve and gradually eased off into the straight with a gradient of not less than 1 in 500. Superelevation is to be given by raising the outer rail of the curve.

274. A formula for determining the amount of superelevation required for the 5'—6" gauge is:—

where S is the superelevation in inches
V is the velocity in miles per hour, and
R is the radius of curve in feet.

Superelevation for curves should be given for the maximum speed permitted on any particular section subject to a maximum of 6 inches and in accordance with the table on the next page.

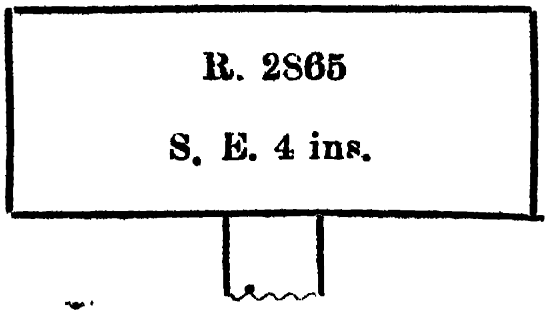
The full height being given at the begining and end of curve and eased off into the straight with a gradient of not less than 1 in 500.

Table shewing Superelevation of outer rails on curves.

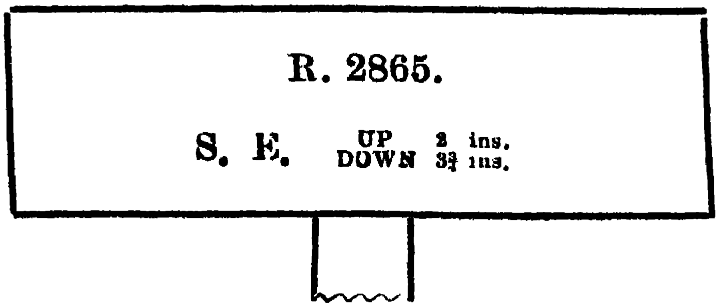
CURVES.		SPEED OF TRAIN IN MILES PER HOUR								
Degrees.	Radius.	20	25	30	35	40	45	50	55	60
1°— 0′	5,730 ft.	⅜	½	¾	1	1¼	1⅝	1⅞	2⅜	2¾
1°—30′	3,820 ,,	½	¾	1	1⅜	1⅞	2⅜	2⅞	3½	4⅛
2°— 0′	2,865 ,,	⅝	1	1⅜	1⅞	2½	3⅛	3⅞	4⅝	5½
2°—30′	2,292 ,,	¾	1¼	1¾	2⅜	3⅛	3⅞	4¾	5⅞	
3°— 0′	1,910 ,,	1	1½	2⅛	2¾	3¾	4⅝	5¾		
3°—30′	1,637 ,,	1⅛	1¾	2⅜	3¼	4⅜	5⅜			
4°— 0′	1,432 ,,	1¼	2	2¾	3¾	4⅞	6			
4°—30′	1,273 ,,	1⅜	2¼	3⅛	4¼	5½				
5°— 0′	1,146 ,,	1½	2⅜	3½	4⅝	6				
5°—30′	1,050 ,,	1¾	2⅝	3¾	5¼					
6°— 0′	955 ,,	1⅞	2⅞	4⅛	5½					
6°—30′	887 ,,	2	3⅛	4½	6					
7°— 0′	819 ,,	2⅛	3⅜	4⅞						
7°—30′	768 ,,	2⅜	3⅝	5¼						
8°— 0′	716 ,,	2½	3⅞	5⅝						

NOTE—The calculations have been made, to the nearest ⅛ inch.

275. The beginning and end of each curve should be indicated by a small board fixed to a stake on which the radius of the curve and the superelevation are marked thus.—



or on a gradient on double track thus—



276 The superelevation of curves should be run out in the straight by 1 inch in 40 feet.

277. Many minor derailments are undoubtedly caused by putting in so much cant behind a switch that owing to the rails being so much in winding some of the tender wheels are actually clear of the rail.

(*a*) It is therefore forbidden to put in cant in yards except at junctions where trains travel at speed, and then it must be limited to the speed actually used, and not to an imaginary 60 miles an hour.

278. With the bogie cars now in use it is essential also to increase the distance between tracks on a curve. The amount of additional clearance to be allowed is laid down in the Appendix to the Schedule of Maximum, Minimum and Recommended Dimensions 1922. It should be noted that the superelevations given in this Appendix are calculated for a speed of 36 miles per hour. The full clearance should be given where the true circular curve begins and should be gradually reached, beginning (like the superelevation) some distance back from the tangent point. Where a station platform is on a curve the distance of the platform wall from the rails must similarly be increased as specified in the Appendix referred to.

Transition curves.

279. It is desirable that transition curves should be introduced at the beginning and end of all curves, but in most cases, with the existing open line, the expense of doing this would be excessive. Engineers should, however, as opportunity serves investigate and submit proposals for the introduction of transition curves on portions of the main line over which trains travel at speed. The actual form of curve is not important. The only necessary condition is that the degree of curvature should continuously diminish from the tangent point of the true circular curve until the straight line is reached, the superelevation diminishing also so as to be everywhere proportional to the curvature (*i. e.*, inversely proportional to the radius).

280. In the Schedule of Maximum, Minimum and Recommended Dimensions 1922 two formula for the length of a Transition Curve are given.

281. The following extracts from Technical Paper No. 192 may be of interest.—

(*a*) "Change of curvature (whether at the junction of a straight line with a curve or in the middle of a compound curve) should invariably be effected by means of "transition curves". This entails the "offsetting" or "shifting" inwards of circular curves pegged out primarily with a theodolite from the tangent point".

(*b*) "The most suitable curve, for the transition from straight line to a circular curve, is a spiral curve known as the "cubic parabola": the formula connecting the length of the transition spiral with the inward "offset" or "shift" "of the crown of the circular curve is $S = \frac{L^2}{24 R}$ where S = the shift in feet; L = the length of transition curve in feet; and R = the radius of the original or "primary" circular curve in feet".

(*c*) "The proper length for a transition spiral depends on the maximum permissible speed on the circular curve which is being approached: it follows that a longer transition is required for an easy curve than for a sharper one because the permissible speed is greater".

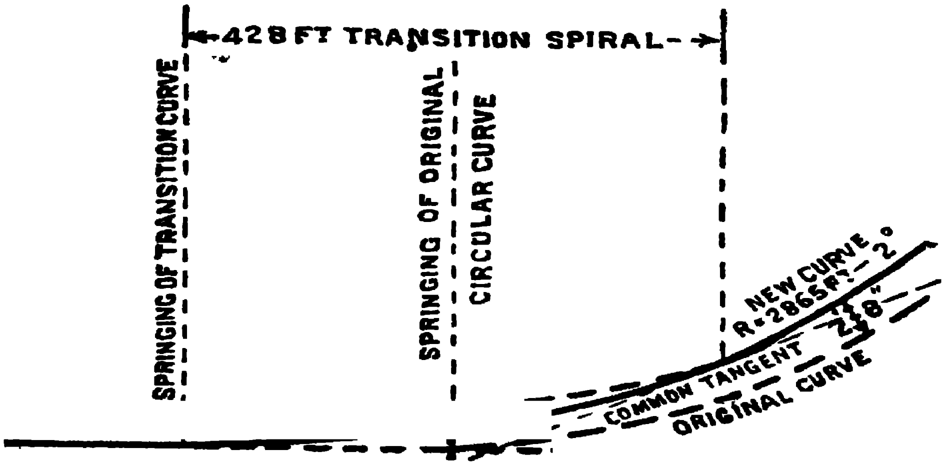
"From principles laid down.. we can deduce that (with certain limitations) the minimum length (in feet) for a transition spiral should be about $8\sqrt{r}$ or $606 \div \sqrt{D}$ where r = radius of curve in feet and D = degree of curve".

"With this length of transition spiral the shift is exactly 2 ft. 8 inches for all circular curves which have to be found to a straight line.

"The formula $8\sqrt{r}$ or $606 \div \sqrt{D}$ gives too great a length of transition spiral for curves flatter than 2° (radius=2865 feet). For such curves a suitable length (in feet) for the transition spiral is given by the formula.

6 × (maximum permissible speed in miles per hour)."

282. The following is an illustration of a transition spiral applied to a 2° curve.



Length of transition spiral$=8\sqrt{r}=8\sqrt{2865}=428{\cdot}2$ feet

$$\text{Offset}=\frac{428{\cdot}2^2}{24\times 2865}=2 \text{ feet } 8 \text{ inches.}$$

Further particulars about Transitions Curves will be obtained in Cole's Notes on Permanent Way Material Article 52.

CHAPTER XIV.

MAINTENANCE OF PERMANENT WAY.—(*Contd.*)

D. O. sleepers maintenance for D. O. road in general.

283. A very large portion of the East Indian Railway system is laid with a cast iron sleeper, known as the Denham Olpherts, and as the proper maintenance of this sleeper is important it merits a full description.

284. The D. O. sleeper is made to suit various rails, *viz.*—

(*a*) the 75 lbs. double headed rail.

(*b*) the 85 lbs. and 88½ lbs. bull headed rail.

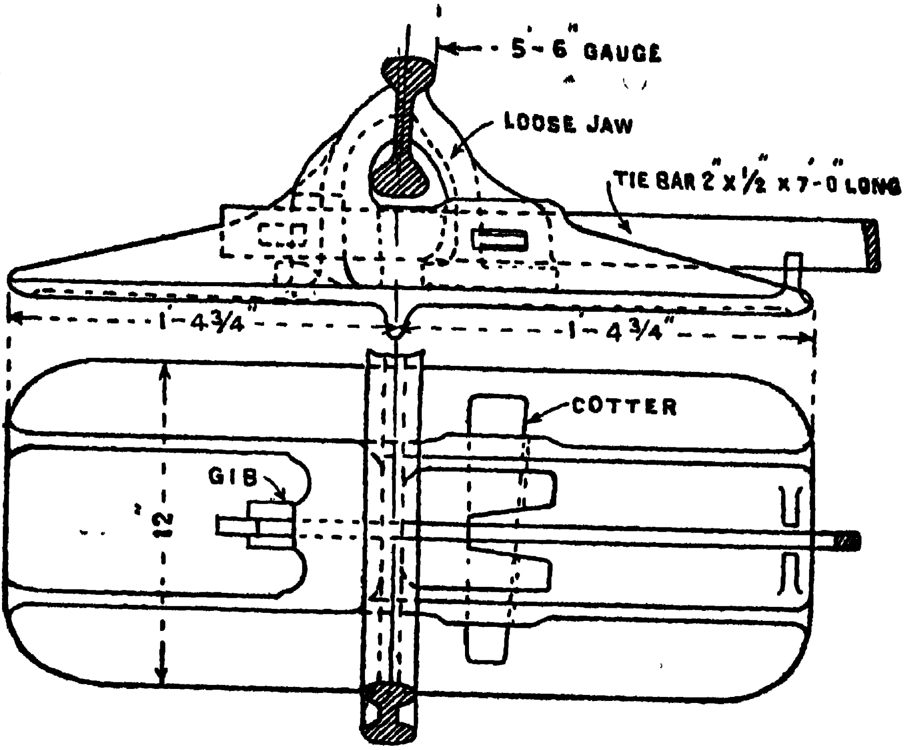
(*c*) the 100 lbs. double headed rail.

285. The latter (*c*) will also fit the 88½ lbs. rail but with a certain tightness of gauge as the same tiebar is common to (*a*), (*b*) and (*c*); therefore it must not be mixed up with sleepers made for 88½ lbs. rails and if used at all with 88½ lbs. rails it should be used in continuous lengths.

286. The D. O. sleeper has many advantages over a wooden sleeper from an economical point of view, the chief of which is that the life is practically infinite, as when broken it can be recast at a small expense chiefly represented by the freight to and from the foundries at Jamalpur. There are several patterns still in existence on the line, but all the old models are being gradually superseded by the standard pattern, which is preferable to any of the earlier types being much stronger and less liable to break in the road.

287. Of the earlier types the one known as the A. F. Company, or "low tiebar pattern," is the one most commonly met with, but this is now confined to branch lines and sidings. In this pattern the end of the tiebar fits into a slot of a central extension of the jaw. Unless the road is very carefully looked after with this pattern heavy breakages are sure to occur sooner or later, as directly a plate settles on the outside and becomes tipped the tiebar acts as a lever, and this speedily results in a breakage of the jaw at the angle between the jaw and its extension, where the casting is unduly weak.

288. The latest standard pattern for the D. O. sleeper is illustrated below :—



It will be observed that the sleeper consists of two cast iron plates with fixed jaws—two loose or moveable cast iron jaws—one wrought iron tiebar – two cotters and two gibs.

(*a*) The flat cast iron plate, which forms the body of the sleeper, has a cross keel immediately below the centre; on the upper side of the plate are two longitudinal check plates to strengthen the sleeper and to support the fixed jaw through an oblong hole in which jaw the tiebar fits and is secured on the outside by the gib.

(*b*) The loose or moveable jaw fits between the check plates opposite to the fixed jaw and is secured by the cotter, which passes through the check plates, the jaw and the tiebar.

(*c*) The underside of the head of the rail is supported on the two jaws.

Sleeper spacing.

289. In every case the joint sleepers should be brought right up to butt against the fishplates and the remainder should be spaced, as shown on Chief Engineer's drawing No. 92160.

290. The centres of the sleepers having been marked off on the rail, the plates on one side are fitted, the outside jaw being butted up tight against the rail; the tiebars are then put through and the gibs fastened; the opposite plates are then slid on to the tiebars and their gibs fastened. The loose jaws can then be fitted and the cotters driven, care being taken to drive the cotters far only enough to hold the jaw to the rail firmly and not to lift it, out of its seat and wedge it against the web of the rail.

(*a*) Care should be taken in this operation that the sleeper is correctly square to the rail.

291. The sleepers are now ready for packing and gauging, which are simultaneous operations.

(*a*) A road laid with Denham Olphert's sleepers requires different treatment from a road laid with wood. With the latter gauging is a distinct operation, but with the Denham Olpherts the operations of packing and gauging have to be done simultaneously.

(*b*) This should be done by four men, two to each sleepers who must pack opposite to each other, commencing under the rail and working outwards. Care must be taken that the whole plate is evenly packed and that the jaws and lugs bear against the underside of the head of the rail, but at the same time it must be seen that the sleeper is not packed so high as to lift the rail head off the jaws of the adjacent sleepers.

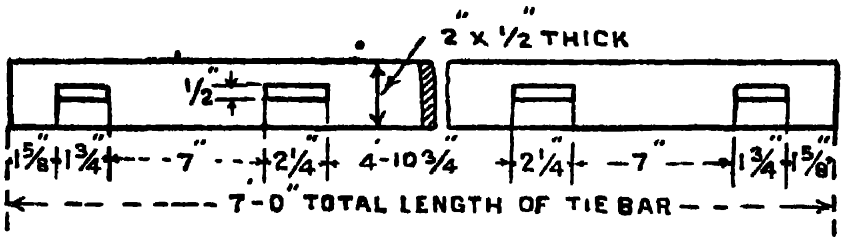
(*c*) It is a common practice when packing a road to leave the inner jaws bearing hard against the rail. The result is that if a jaw is gripping the web only and not the shoulder the rail is raised in packing and the jaw does not get its proper bearing under the shoulder. It must be seen therefore that all cotters are slacked off first before packing is commenced and re-tightened after the packing is completed.

Care must be taken to raise the plate evenly when packing. This can only be done by the two men striking with the beaters evenly and simultaneously from opposite sides of the plate; packing from the ends should be avoided. Not less than a rail length can be packed properly at one time, as the sleepers cannot be fully packed at one operation. All the sleepers along the rail should first be packed lightly until the jaws just touch the rail. The work should then be completed, and the packing made solid, using the gauge and level during the operation.

292. The sleepers when gibbed and cottered, if the plates are level, should all be true to gauge: but this will not generally be realized in practice owing to the variation in the slots of the tiebars, which in some cases amounts to as much as a quarter of an inch and to variations in the plates themselves.

Tiebars.

293. A tiebar of correct manufacture is illustrated below:—



294. The tiebars should be gauged and sorted and the different lengths marked distinctly: tiebars of the same length between slots should be placed in the road continuously and the correct gauge obtained by packing.

295. Certain tiebars for 85 lbs. sleepers with a hole punched through them are of old Jamalpur manufacture and are incorrect to gauge. When used these should be laid in continuous lengths as stated above.

296. To lessen the effects of the resulting inequality in gauge some Inspectors straighten one rail and pack the other half an inch higher in order to throw more weight on to the straight rail and reduce oscillation. It is stated that this improves the running, but this improvement is more imaginary than real and in any case it is only a makeshift. The best remedy next to having properly gauged tiebars supplied is to sort them all out before putting them into the road and to keep together all those of one size for use in one continuous length rectifying any small irregularity remaining by judicious packing.

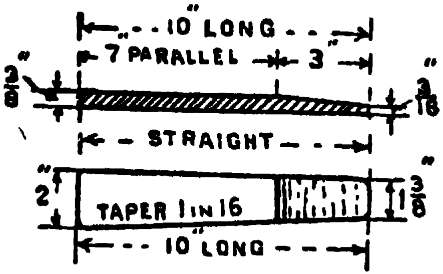
297. But irregularity in length of tiebars is not the only source of varying gauge. The plates themselves vary in several ways. When in addition to these it is remembered that the gauge can be altered by the manner in which the plates are packed it will easily be understood that to get a road laid with these sleepers true to gauge and perfectly straight requires a great amount of care and attention on the part of the Inspector.

298. If when the sleeper is laid and has received its first packing it is found to be tight to gauge, the correct gauge can be obtained by packing the inside of *both* plates simultaneously—or if wide to gauge by packing the outside of both plates; but care must be taken that the difference in level of each plate shall correspond to that of its fellow at the other end of the same tiebar.

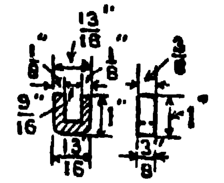
In other words on a straight road the edge of a tiebar should be parallel to a straight edge laid across the rails; both plates should either be level or both equally tilted inwards or both equally tilted outwards in order to obtain correct gauge. On a curve the same conditions should obtain, allowing for the superelevation. Failure to secure this may result in the tiebar bearing hard upon some part of the plate and causing a fracture.

After the cotters have been some time in the road it will be found that by continual driving the edges wear as also the end of the tiebar slot against which the cotter bears. This means that in time the cotter can be driven in so far that it is by itself of no further use as a wedge for tightening. It is then necessary to put in liners for tightening.

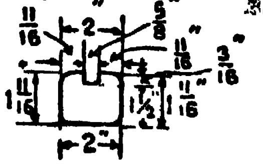
Liners. **301.** These liners should be of the shape shown below in sketch—



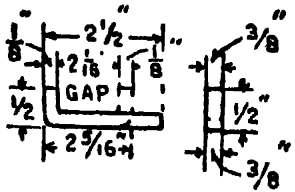
COTTER



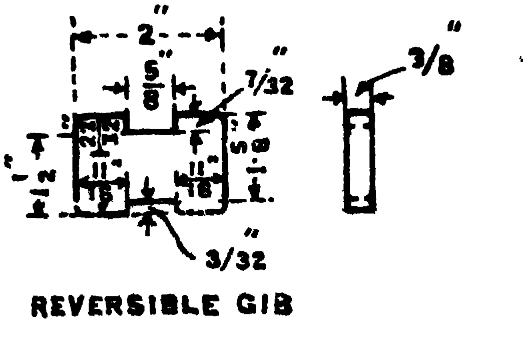
COTTER LINER



GIB



GIB LINER

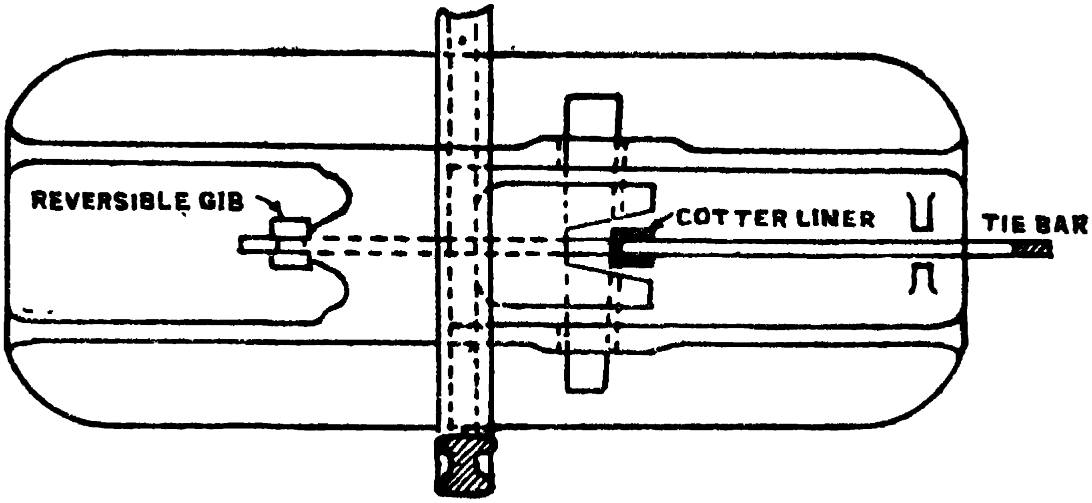


REVERSIBLE GIB

301. They should be used on the D. O. plate as below being inserted through the slot of the tiebar so that the cotter bears on the one side on the loose jaw and on the other side against the liner.

301 A. When the new reversible gib is supplied in sufficient quantities this will be used and gib liners may be done away with.

The new reversible gib will be fitted as shown on the sketch below:—



302. When gibs become worn it is considered better to replace the worn gibs by new ones using up the worn gibs on curves. This, however, it is recognized, is not always a remedy, as the slot in the tiebar and the part of the plate against which the gib bears may also have become worn and it may become necessary in order to retain the gauge either to manufacture and use larger gibs or to employ liners with the gibs also

303 Similarly the fixed jaw or the loose jaw of the plate or the base of the plate where the loose jaw rests may get worn and the jaws may fail to retain their grip of the rail. It is the good Inspector who facing these conditions can make the best of them and maintain a good running road.

304. For curves in order to get the necessary allowance in gauge mentioned in the preceding chapter Inspectors can make their own special gibs from standard gibs. These gibs must be specially marked so as not to be mistaken for standard gibs.

305. The custom in maintaining wooden sleeper road is to open out and pack right through once a year and after that is done to pick up the low places by opening out and packing a few sleepers at time. On a wooden sleeper road this system may answer, but some Inspectors apply the same treatment to the D. O. road to which it is not suited, as it is impossible to pack Packing.

up D. O. sleepers so accurately as to get the low ones to take a sufficient bearing without affecting their immediate neighbours: what always happens is that the rail is more or less lifted off the jaws of the adjacent sleepers that are not packed, the bearing is not even or continuous and a rough road results.

306. It should be a standing order on the Denham Olphert's road that nothing less than two entire rail lengths (both sides) are to be opened for packing and that they are to be packed throughout.

The road should not be packed up hard at once, but should be worked over a second time after traffic has passed over it.

307. The Denham Olphert's road is more easily and quickly worked over than the wooden road, but it also runs down more quickly; the joints especially giving trouble.

308. Another important principle with this road is that, whatever work is done to it which in any way disturbs the sleeper beds, it must be packed over before being left, otherwise breakages are likely, to occur.

Boxing up broken material.

309. Breakages usually occur from imperfect packing. Mates are apt when packing over a road to cover up breakages to save themselves the trouble of renewing them and they should therefore be absolutely forbidden to box up any broken material. A small stock of plates and jaws should be maintained at all gate lodges so as to be handy for renewals and all broken material in the road should be replaced at once.

310. This broken material should never be left lying about, but immediately collected and taken to the nearest gatelodge for disposal later. A section littered with broken material is a reflection on the Inspector concerned.

311. The Denham Olphert's road is not as stable as the wooden road at high speeds and should always be fully ballasted especially on the haunches. The ballast between the rails should be level with the top of tiebars. The ballast at the edges outside the haunches should be neatly finished off, a piece of string being used to give a straight line.

This road is also apt to get crooked, and even to buckle, if long lengths are left opened out in the hot weather.

Ballast.

The ballast for the Denham Olphert's road should always be well broken and should pass through a 1½ inch ring any way. There should be a good cushion of ballast under the sleeper the minimum, depth recommended being 8 inches. See Schedule of Maximum Minimum, and Recommended Dimensions and remarks in para. 354.

312. Where different types of the Denham Olphert's sleeper exist in the road they should always be laid in continuous lengths, sleepers of the same kind being grouped together.

313. When from neglect or other causes the rails have become "hogged," *i e.*, taken a permanent set at the ends, it is impossible to pack up the joint sleepers, as, directly they are packed up sufficiently for the jaws to take a bearing, the rails leave the jaws of the centre plates. **Hogged road.**

The causes of this evil are various—permitting joints to remain low for long periods,—too long a space between the joint sleepers—want of ballast under the sleepers. The latter defect with a Denham Olphert's road almost always ends in hogged rails, as with the old kunker and dirt which underlies the stone ballast on the upper part of the East Indian Railway the iron plates very soon form an exceedingly hard bed for themselves resembling concrete which becomes an anvil repeated blows on which from the wheels eventually giving the ends of the rails a permanent set. With wooden sleepers a certain amount of elasticity in the sleeper itself modifies this action.

Considerable attention must therefore be paid to the sleepers at the joints of rails that have once got hogged in order to bring them back as far as possible to their original condition.

CHAPTER XV.

RELAYING OF PERMANENT WAY.

314. As a general rule no work endangering the safety of the line may be undertaken during foggy or tempestuous weather.

315. It is usually known well beforehand on which section of the line relaying is to be carried out and advantage should be taken of this to make the necessary provision in the Time Table for the delays to traffic that will be involved.

316. The Superintendent, Way and Works, will intimate when he proposes to start relaying and from what point and the approximate period the work will be in progress, and will arrange for the necessary notice to appear in the Weekly Gazette. It is important that the matter be attended to early, so that relaying may start in ample time and be carried out in an orderly and efficient manner.

317. Prior to the commencement of actual relaying the Permanent Way Inspector should see that the new rails are lined up butt to butt in the centre of the track or on the cess as convenient and that all rails are perfectly straight and true and as far as possible of the same length. Rails which are kinked should be straightened with the jimcrow prior to being put in the road. Short rails should not be mixed up promiscuously with long rails, but assembled together at one end of the length except those short rails that are necessary for the inside of curves.

318. Each day before relaying is commenced it will be the duty of the Permanent Way Inspector in charge of relaying to hand a notice in Form 154 (if the work is outside stations) and in Form 110 (if the work is inside station limits) to the Station Master on the side of the relaying from which, in the case of double line trains may be expected or to the Station Master nearest to the relaying in the case of single line, and obtain a receipt for same. He will also fill in a telegraphic advice, which he will hand to the same Station Master, addressed to

(*a*) the Station Masters at the stations on either side of the place concerned, and

the Station Master at the last stopping station of trains, other than Goods, which are booked to run through.

(*b*) the Running Shed Foremen of the sheds at the ends of engine runs on either side.

(c) the Divisional Superintendent, Superintendent, Way and Works, Assistant Engineer and the Train Controller.

319. The Station Master who despatches the telegraphic advice received from the Permanent Way Inspector will be responsible that it is correctly addressed and promptly despatched to the correct stations and that acknowledgment is received.

320. The Permanent Way Inspector during relaying operations should provide himself with a set of portable telephone instruments with which he should keep himself in touch with the Train Controller, or the Station Master, as may be most convenient, regarding the running of trains. Prior to the commencement of the work he should ascertain particularly if any special trains are running that day.

General Rule 339.

321. No person employed in the Way and Works shall commence any operation such as changing or turning a rail, which would obstruct the line and necessitate the shewing of Danger Signals—

(a) Until such signals have been shown and

(b) If within station limits, until he has also obtained the permission of the Station Master, and all necessary signals have been placed "on."

Signalling arrangement.

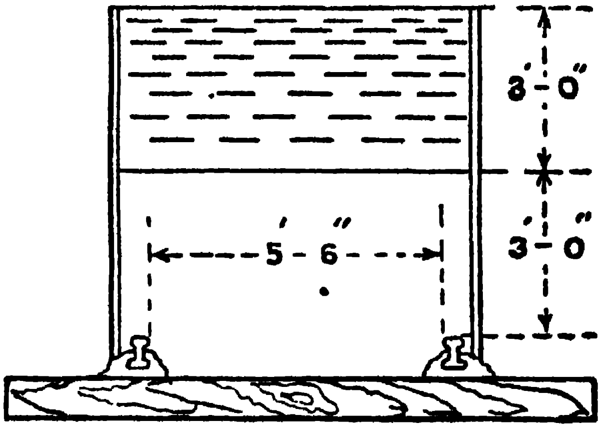
322. Before any such work is commenced and during the progress of the work the following day signals will be exhibited and the Permanent Way Inspector will be personally responsible for seeing that these are correctly placed and that the men in charge are fully acquainted with their duties:—

(A) On double line in the direction from which a train may be coming.

(1) At a distance of 6 furlongs from the point of danger—3 fog signals spaced 10 yards apart.

(2) At a distance of 3 furlongs, or half way out, one fog signal and a man with two flags, red and green. The red flag, which may be a banner flag as indicated below, is to be exhibited until the train is brought to a stand unless in the meantime the Signalman has been advised by signals from the Inspector in charge of the work that the train may be allowed to proceed, in which case the fog signal is to be removed and the green flag exhibited. These flags must not be less than 2 feet square, clean and of bright colours.

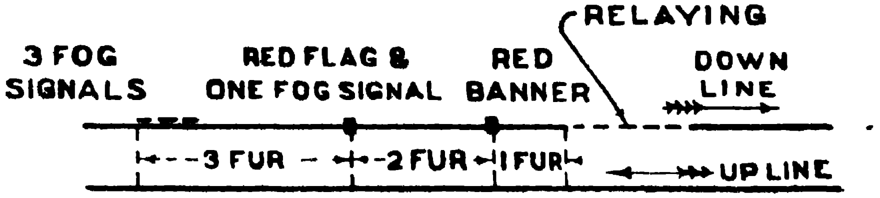
(3) At one furlong from the point of danger a red banner across the line as per sketch below:—



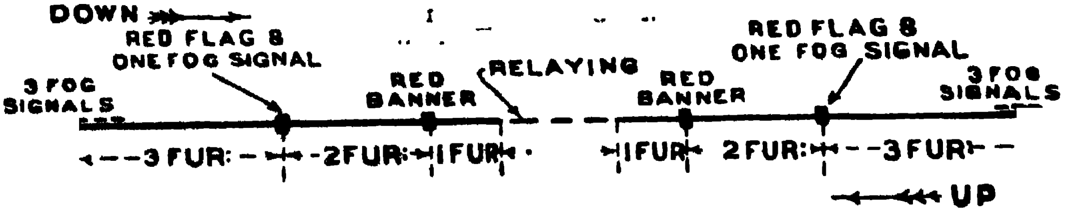
(4) The Permanent Way Inspector or his Assistant or his Head Mistri should himself stand during the passing of a train with a green flag to indicate to the driver of the train when the whole of that train has passed over the relaying, in hand on that day.

323. The following diagram shows the disposition of these **day** signals.

(A) On double line where only one line is concerned.



(B) On single line these signals will be exhibited on both sides of the relaying as below:—



324. These signals are to be exhibited whether the relaying is inside or outside station limits. When the work is inside station limits the Permanent Way Inspector has the additional protection of the station signals. As no work must

56th Addendum and Corrigendum to the Standing Orders of the Operating Department.

For S. O. 156 "**Transhipment of Goods,**" *page* 60, *substitute the following,* namely—

"156. **Transhipment of Goods including Coal.**—The following are the instructions regarding the issue of transhipment advices in connection with consignments of goods in full wagon loads including coal.

1. A transhipment advice by post (on embossed Post Card C. 99 B) must be sent to each of the following—

In Local Traffic.—Sending and destination stations, Chief Commercial Manager (Claims), Calcutta, and Divisional Superintendent within whose jurisdiction the destination is situated.

In Foreign Traffic.—Sending and destination stations, Chief Commercial Manager (Claims), Calcutta, and junction stations.

In the case of coal traffic booked locally, transhipment advice on embossed Post Card C. 99 must be sent to the Head Weigh Clerk of the sending and the Station Master of the destination stations and to the Coal Area Superintendent, Dhanbad, instead of to the Chief Commercial Manager or the Chief Operating Superintendent, Calcutta. In the case of East Indian Railway Loco. coal, the Running Shed Foreman concerned should be advised in addition.

In Foreign Traffic (Coal).—In addition to the sending, destination, junction stations and the Coal Area Superintendent, Dhanbad, the Central Claims Offices of the Railway concerned should be advised and when coal is booked to the North-Western Railway (Loco.), the Fuel Distributor, North-Western Railway, Ghaziabad, should be advised by a wire and the same confirmed by issue of a Post Card Advice (form C. 99).

2. Destination stations receiving a Post Card must note the transhipment so as to be able to connect the consignment with the invoice promptly.

3. Junction stations must record full particulars of the transhipment advice received by Post Cards C. 99 B and C. 99 in the Through Wagon Register, so as to be able to reply to references from Foreign Railway stations and officials.

4. The staff, when preparing transhipment advices on Post Card C. 99 B for goods and C. 99 for coal, must shew the name of the owning railway of all the wagons i.e., the wagons damaged and the wagons into which goods have been transhipped.

5. Indents for Post Cards C. 99 B and C. 99 are to be made by the Divisional Superintendent either to the Treasurer or Printing Superintendent, Howrah, and they, in turn, will supply Station Masters and Goods Inspectors under their jurisdiction in accordance with their requirements.

6. Transhipment advices shall only be sent in the above forms C. 99 B for goods and C. 99 for coal, and these Post Cards shall be accounted for separately in the Register Book C. 41 to be maintained at all stations and checked periodically by Inspectors. These registers are to be maintained for both "Goods" and "Coal" combined, but a remark should be made in the "Remarks" column to show which items refer to "Goods" and which to "Coal."

The Standing Order Book should be corrected accordingly.

Chief Operating Supdt.'s Office,
E. I. Ry.
Calcutta, the 5th May 1937.

W. H. H. YOUNG,
Chief Optg. Supdt.

EI. 217—15,000—21-5-37—EIR.

37th Addendum to the Standing Orders of the Operating Department

In sub-paragraph (6) of S. O. 136 **“Transhipment on Weighment of damaged tank wagons,”** *pages 50 and 51 as appeared in the 35th Corrigendum to the* Standing Orders of the Operating Department, after the word “Burdwan” *in the* list of stations, add the following, namely :—

“Sahibganj”

The Standing Orders Book of the Operating Department should be corrected accordingly.

Chief Operating Supdt.’s Office,
E. I. Railway,
Calcutta, the 11th May 1937.

W. H. H. YOUNG,
Chief Operating Supdt.

EI 243—15,000—22-5-37—EIR.

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ment of damaged tank wagons.”

The Standing Order Book should be corrected accordingly.

Chief Operating Superintendent’s Office,
E. I. Railway,
Calcutta the 14th June 1937.

W. H. H. YOUNG,
Chief Operating Superintendent.

EI 400—15,000—25-6-37—EIR.

E. I. Railway, Calcutta.

The 5th October 1937.

Chief Operating Superintendent.

EI 1041—15,000—26-10-37—EIR.

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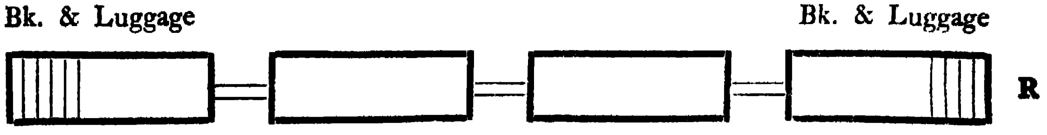
(4). Page 22, S. O. 52-I. Insert the following as S O. 52-I. (g) :--

“(g) **Attaching of Brake-vans to Mails, Express and Passenger trains.**—Brake-vans are never to run in reverse order. That is to say, that on any train the brake and luggage compartment of the van is always to be either next the engine or to the rear of the train, thus—



N. B.—This does not apply to trains authorised to be worked with one brake-only.”

The Standing Order Book should be corrected accordingly.

Chief Operating Superintendent’s Office,
E. I. Railway,
Calcutta, the 18th October 1937.

W. H. H. YOUNG,
Chief Operating Superintendent.

EI 778—15,100—25-10-37—EIR.

be commenced until all necessary signals have been placed "on" so no signal affecting the line under relaying must be lowered until the line has been restored and the Permanent Way Inspector authorizes the Station Master that the signal may be lowered.

325. On completion of the work for the day the Permanent Way Inspector will cancel the notice by the slip provided in Form E. 154 if the work is outside station limits or by Form E. 110 A. if within station limits. He will also cause telegraphic advice of this cancellation to be sent to the officials named in the telegram imposing the day restriction and warn them that night signals have now been exhibited and that trains must run with caution.

Speed Restriction.

326. On days when no work is in progress and during the night when the relaying for the day has been completed the following caution signals shall be clearly exhibited as for a temporary speed restriction:—

Signals.

(A) On double line in the direction from which a train is coming.

(1) A post with a green painted iron disc 3 feet in diameter and carrying a green lamp to be fixed 3 furlongs from the point where restriction of speed has actually to commence.

(2) A similar post similarly equipped to be fixed the point where restriction of speed has actually to commence.

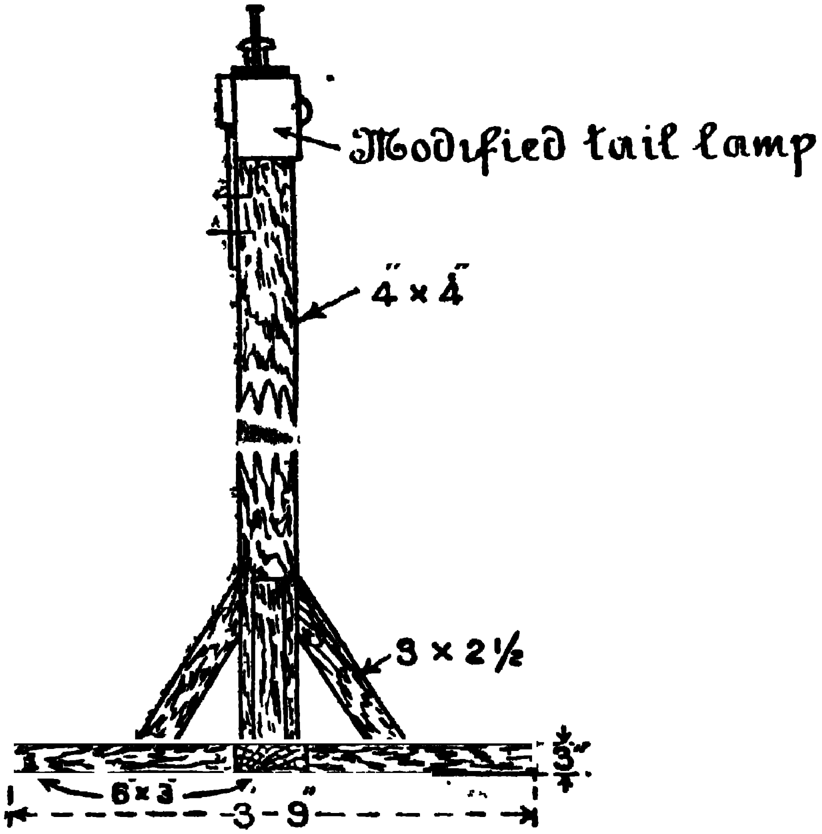
(3) A third post similarly equipped to be fixed 3 furlongs in advance of the furthest part of the length under restriction, to indicate to drivers where to accelerate.

(B) On single line these signals will be exhibited on both sides of the relaying.

327. These iron discs should be painted green to face the Driver and white on the reverse. The posts must be securely fixed in the ground, so that the nearest edge of the disc will be at least 7′-6″ from the centre of track. They should be of sufficient height as to permit of the signal being clearly visible by the Driver of an approaching train.

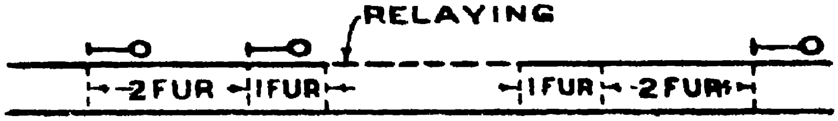
The lamp should be fixed in the centre of the disc. The type to be used is known as the "Modified Tail Lamp (green lens.)"

Permanent Way Inspectors must keep in stock to meet possible requirements a sufficient stock of posts, discs and lamps.

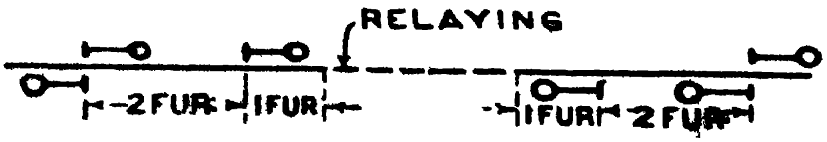


328. The following diagrams show the disposition of these night signals :—

(A) On double line.



(B) On single line.



329. On sections or parts of the line where the view is obstructed the distances given above should be increased to such an extent as may be necessary to ensure absolute safety and if necessary the number of signals may be increased. This refers both to day and to night signals.

330. The above rules apply where the line is on a level or on a gradient not steeper than 1 in 500. For a gradient of 1 in 500 or steeper falling towards the point of danger these distances must be increased under the orders issued by the Engineer-in-charge.

331. It is absolutely necessary to carry on all relaying work in such a way that the minimum obstruction and detention to traffic, and the maximum of safety to trains is obtained. With the increasing number of fast trains running a restriction of speed over long lengths means upsetting the regularity of the entire service throughout the line.

332. No more of the ballast on the track is to be opened out ahead than is required for the following day's relaying.

333. No more of the track is to be unlinked ahead than can be laid, packed and straightened in one day's work and the track behind is to be lifted, packed and fully boxed up to the top of the sleepers and restored to perfect running order without delay. The three operations of unlinking of track, linking in and restoring the road to perfect running order must not extend over more than a mile at one place and no two such places are to be within 10 miles of each other if possible.

334. Rapid work depends more on adequate preparations than on rapid laying. It is therefore the duty of the Superintendent, Way and Works, and of the Assistant Engineer to see that every possible precaution is taken beforehand to ensure that nothing occurs to delay progress. In no case must the work be scamped for the sake of rapidity of progress. Good rails may very easily be ruined in a very short time through scamped work.

335. The following orders must be closely observed:— **Relaying orders.**

(*a*) Sufficient rail gauges, gauges for squaring joints and "wedges" must always be on the work.

(*b*) The rails are to be closed tight on to the "wedges," the fishplates applied and bolted with two bolts, these bolts being tightened up and then slacken back the nuts half a turn to hold the rails in line. All fishplates and fishbolts before being fitted to the rails must be smeared with the special grease compound made of tallow, castor oil and common graphite as prescribed in Chief Engineer's Circular No. 1 of 1915. See para. 236.

(*c*) The "wedges" are to be kept in position for at least four rail lengths at a time.

(*d*) It should then be seen that all joints are tight and if not they should be drawn up tight.

(*e*) The joint sleepers should then be moved if necessary into their correct positions and roughly packed up.

(*f*) The centres of other sleepers should then be accurately chalked off on one rail and the sleepers moved to their positions under that rail and engaged thereto.

(*g*) This rail should then be aligned and the centres of sleepers squared off on the other rail.

(*h*) Rail gauges must then be placed in position and the track packed to correct gauge, alignment and level.

(*i*) The greatest care is to be taken to ensure the correct gauge being obtained.

(*j*) Care must be taken that on the straight the rails are truly level across and that on curves the proper superelevation is given.

(*k*) Each joint is to be finally bolted up with four bolts as tight as one man can tighten them with a spanner whose handle is not more than 2 ft. long on the standard gauge and 15 inches long on the metre gauge. When so tightened all the nuts should be slackened back one-eighth of a turn. Nuts should be gone over and tightened twice within one month after linking.

(*l*) No crooked rails are on any account to be laid. The slightest kink in a rail has a pronounced effect upon smooth running and if it occurs near a joint may tend to hogging. The greatest care must therefore be taken to remove kinks before the rails are laid in the road.

Staggered Joints.

336. On relaying the joints may be "staggered." If joints are not staggered on curves as soon as the lead of the inner rail is equal to the distance between fishbolt holes a length should be sawn off the end of the rail equal to the distance between the fishbolt holes and a new fishbolt hole drilled.

Expansion
~~Experiment~~
at Joint.

337. Great care must be taken to ensure the space between adjacent rails (*i. e.* the joints) being the right size. If too little expansion is given the line will "buckle" in the hot weather; whereas if too much expansion is given the joints will "knock" in the cold weather or the fishplates or bolts may snap.

338. "Wedges" should be of metal plates and of such a pattern as to admit of the wheels of a train passing over them without jamming them.

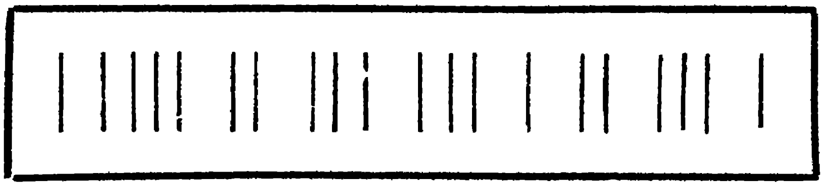
339. Two sets of expansion gauges consisting of a thermometer in box and two bundles each of "wedges" for 36 ft. and 30 ft. rails are required on relaying to ensure a proper spacing of the joints.

340. The thermometer usually used is 12 inches long and is graduated from 20° F. to 320° F. It is enclosed in a round wooden cylinder 13½ inches long by 1¼" diameter.

341. The expansion for each rail joint is to be given in accordance with the table given below :—

Approximate temperature in sun by Thermometer.	Clearance for expansion.	
	For 36′ and 37′ rail.	For 30′ rails.
120°	1/8 inch	1/16 inch.
100°	3/16 „	1/8 „
80°	1/4 „	3/16 „
60°	5/16 „	1/4 „
40°	3/8 „	5/16 „

342. At the end of a day's work the Permanent Way Inspector will check all the rail joints by marking them off on a strip of paper placed on the rails each joint being marked off consecutively thus. The best way to do this is to make "rubbings" of the joints.



The strip of paper is to be laid on the first joint and the joint marked on it actual size. It is then to be taken to the next joint and that joint marked in continuation of the previous one and so on. The series of joints as marked on the paper will assume something of the appearance shown in the above sketch.

The sketch as made would indicate a very badly laid bit of road. On a well laid portion the joints would of course be much more regular.

These sketches are to be submitted to the Superintendent, Way and Works, through the Assistant Engineer daily. Where the sketches indicate bad laying steps should be taken at once to put matters right.

Storage of small fittings.

343. Small fittings such as keys, spikes, fishplates, fishbolts, etc., required for relaying are not to be unloaded along the line and left unguarded. They must be kept at stations, gatelodges or gang huts and run out daily by trolley, only as required.

344. Similarly all old fastenings recovered from the work are to be collected daily and placed in safe custody and not left scattered about the line.

(*a*) When rail renewals are carried out there is often great laxity about bringing in the old fishbolts and spikes large numbers of which disappear. It should be distinctly understood that the Permanent Way Inspector in charge of the work is responsible for proper arrangements being made to account for every fastening released from the line whether it is serviceable or not and Assistant Engineers should see that it is done.

345. Care should be taken to screw the nuts of released fishbolts on to their bolts immediately they are removed from their fishplate so as to prevent loss.

343. The rails recovered from the relaying must also be brought in as quickly as possible. If left lying about the line they form a potential danger to traffic.

Daily reports.

347. On completion of each week's work the Permanent Way Inspector will submit to the Superintendent, Way and Works, through his Assistant Engineer a return on Form E. 76 of the progress done to date. He will also send a copy of the same return direct to the Chief Engineer. Great care should be taken in the preparation of this return as errors lead to useless correspondence.

348. In the preceding paragraphs reference has been made only to the ordinary procedure of relaying. Where a rail of the same type as the old one is being relaid with entirely new sleepers it may often save delays to traffic to change the sleepers beforehand as a distinct operation or it may be considered better policy to interlace these new sleepers in the existing track with the new rails linked thereon and when relaying commences to throw out the old road and slew the new road into position. The governing factor is the time allowed between trains for relaying operations. Good work is not necessarilly implied by rapid progress and scamped work cannot be tolerated.

CHAPTER XVI.

POINTS AND CROSSINGS.

349. All points and crossings will be manufactured in accordance with para. 220A.

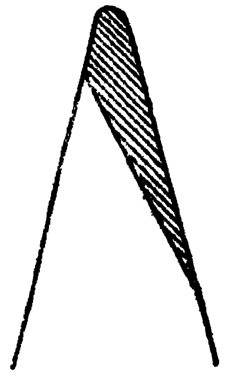
Standards. **350.** The standard types of ordinary crossings are 1 in 8, 1 in 8½ (Lucknow and Moradabad Divisions), 1 in 10 and 1 in 12. The 1 in 12 is intended for turnouts from the main line over which passenger trains are to run and is used in conjunction with either an 18 ft. switch or a 36 ft. spring switch. The 1 in 10 is in general use in passenger yards over which trains do not run at great speed (See the Chapter on Speed of Trains) and 1 in 8½ and 1 in 8 in Goods Yards and in less important positions in Passenger Yards. In future the standard will be 1 in 8½.

Gauge and clearance of crossing. **351.** The standard types of diamond crossings are 1 in 8, 1 in 8½ and 1 in 10. The use of 1 in 10 diamonds should be restricted as much as possible, as during shunting operations there is a liability for wagons to jump the nose of the crossing and to take the wrong track.

352. There are in stock many points and crossings other than those described and these should be used up at the earliest opportunity. They must not be kept in reserve.

353. The condition of points and crossings should always receive special attention, and all fastenings, including locking bolts, must be kept in perfect condition. The gauge of tracks must be kept *exact*, and the check rail clearances should be constantly checked. The sleepers must be kept in perfect condition and any defective ones changed. The condition of the ballast and of the drainage is a matter of great importance, which is more often than not neglected.

(*a*) Special care should be taken that the clearances of guard rails opposite the nose of crossings are in accordance with Standard Dimensions, *i. e.*, $1\frac{7}{8}''$ for Broad Gauge and $1\frac{3}{4}''$ for Metre Gauge (maximum) otherwise the nose of the crossing will be shaved off like the hatched portion by passing wheels.



(*b*) The guard rails wear rapidly and will need changing. The wing rails also wear rapidly on the top on either side of the nose of the crossing. They should be renewed as soon as the wear is about $\frac{1}{16}''$ to $\frac{1}{8}''$ deep. This will save the more expensive crossing.

Switches.

354. The heels of switches are often allowed to become unduly slack. It is only necessary that the first bolt should be quite slack, the next bolt should be only very slightly slack and the last two quite tight, as :—

(*a*) The two bolts at the back of the heel of the switch can be kept tight.

(*b*) The two bolts at the heel of the switch being slack allow the switch to work smoothly.

(*c*) The fishplates should be bent about ¼" at one end.

(*d*) In order that the boltnuts at the heel of the switch shall not work unduly slack or drop off altogether a hole should be bored in the bolt and a split pin inserted.

(*e*) Permanent Way Inspectors should pay special attention to this and also see that in all cases the switches "home" properly under the stock rails.

(*f*) When fish plates are given a set all bolts should be kept tight. The first bolt should never be quite slack it should only be slackened back one turn.

Gauge tie plates.

355. All points passed over by passenger trains should have two gauge ties, one ahead of the switch toe, and one behind the back of the stretcher bar.

All other points should have one gauge tie ahead of the switch toe.

Bed Superelevation.

356. Crossing leads must all be checked and corrected where necessary, and the curves of all crossovers or turnouts kept perfectly true. Within station limits no superelevation need be given to the outer rail of a curve, except on main line and loops passed over by trains at speed. There must be no change of superelevation between points 50 feet outside toe of switch and nose of crossing respectively.

Diamonds.

357. In the case of diamond crossings provided with slips, single or double, the track is subjected to considerable side pressures and great care must be exercised in keeping the alignment and the gauge in truth. Gauge tie plates at the nose of the points should invariably be used.

358. Where points, as in the case of Colliery sidings, are provided with a safety lock the ends of the bolts securing the safety lock should be burred over to prevent the lock being removed and the points being tampered with.

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Addendum to para. 359, *page* 102—

It should be noted that in all new works or Remodelling schemes the clear standing room of loops or sidings should be measured from the point where the distance between centres of tracks begins to be less than 15 feet 6 inch centres

CHAPTER XVII.

ACCIDENTS AND OBSTRUCTIONS.

360. On the occurrence of an accident on any Division caused through slips, collision, floods, derailment or from any other cause, resulting in damage to the road and thereby blocking it and delaying trains, it will be the duty of the Assistant Engineer and Permanent Way Inspector at once to proceed to the scene of the accident. On receipt of an *Urgent* telegram from the Assistant Engineer or the Permanent Way Inspector (whoever first reaches the scene of the accident) giving details and stating what help and materials are required to restore communication the Superintendent, Way and Works, will arrange for the necessary labour and material, and if necessary, proceed with it by the quickest method to the scene of the accident. **Duties and reports.**

361. It is the business of the Senior Engineer or Engineering Subordinate who first reaches the scene of the accident to take charge and restore communication (remembering that it is the duty of the Power Officer to first clear away any vehicles, etc., that may be fouling the line) after making a sketch of the scene of the accident and taking such notes as will be necessary to enable the cause of the accident to be ascertained. He will without undue delay send a telegram stating:—

(*a*) Station or mileage.

(*b*) Cause of accident, if known.

(*c*) Extent of damage to road.

(*d*) Nature of assistance (if any) required.

(*e*) Number of hours which will elapse before communication is restored.

This message, classed Urgent, will be addressed to the Agent, copy to the Chief Engineer, Chief Operating Superintendent, Divisional Superintendent, Chief Mechanical Engineer and the Senior Government Inspector.

362. In the first place however steps should be taken to protect the line, (or lines if both tracks are fouled) by means of fog signals, flags and banner flags in the manner and at the distances laid down in the Chapter on Relaying.

363. At night instead of flags and banner flags lamps will have to be provided at the same distances. If the line is for the time being entirely blocked, as by a breach due to flood or by vehicles fouling the line due to a derailment or collision, these lamps should show red, the lamp furthest from the scene of accident being changed to green only on instructions from the Permanent Way Inspector or the Officer controlling traffic operations. If the line is not entirely blocked and if trains can be permitted to pass with caution and *after all the staff have been advised by telegram and caution orders issued* green disc signals may be erected as given in the Chapter on Relaying.

364. It is desirable that the Chief Engineer should receive reports of serious accidents at the earliest possible moment.

365. It is of course the first duty of an Engineer on arriving at the site of an accident to set about doing what is necessary for the resumption of traffic, but, having put this in hand, he can always find time to write a few notes on the position of affairs, including the nature of the accident, probable cause, description of the condition of affairs at the time of writing, with sketch if possible, damage to permanent way and works, steps being taken for resumption of traffic, probable time when traffic will be restored and anything else of immediate interest. These notes may be written in pencil on pages torn from a note book and may be quite informal. They should be sent to the Divisional Superintendent either by special messenger or by whatever means appears to be the best for ensuring their being despatched at the earliest possible moment.

(*a*) The sketch should shew position of vehicles, any marks on rails and any information that is likely to be of use in elucidating the cause of the accident and should have all important dimensions shown thereon.

(*b*) If the Superintendent, Way and Works, is not present himself the Assistant Engineer or any Engineer who happens to be on the spot even if it is not on his own division is to send the notes to the Chief Engineer direct It will be understood that the object in view is that the Chief Engineer may have EARLY authentic information as to what has happened and what action is being taken and that these instructions are not intended to convey any alteration in the existing procedure as to the formal reporting of accidents.

366. In all cases of accident in which Railway officers suspect malice copies of the telegram notifying the accident must be given to the Government Railway Police and the Engineering Department be asked to convey the Government Railway Police out to the spot by trolly if no train is due at once.

367. In the case of *operations involving danger to trains* such as changing of rails, of bridge timbers, slewing or lifting of track or work of a similar temporary nature the *procedure* will be the same as, and the *day* and *night* signals will be the same as for Relaying, *it being remembered that no work is to be undertaken at night or during foggy or tempestuous weather.* These instructions must be most carefully observed. In cases of emergency as in the case of a rail found broken in the road the Permanent Way Inspector or other Engineering Official will impose a block or a caution immediately, and at once take steps to have matters put right.

Local notices regarding work.

368. When the work is of a nature that can be foreseen and will not take long in carrying out the Inspector must give 48 hours notice of his intention to carry out this work, the time when he proposes to start and the probable duration of the work, in order to enable the Train Controller to arrange his train movements.

This does not apply to work that is part of a programme such as relaying, extensive bridge renewals, etc., which should be advertised in the usual way in the Weekly Gazette.

369. When one track on a double line is to be blocked semi-permanently as on account of a serious slip or on account of repairing of a bridge it may be necessary to construct a block hut with points and crossings and fixed signals at the obstruction, and to introduce single line working, or to construct a diversion round the obstruction.

Diversion.

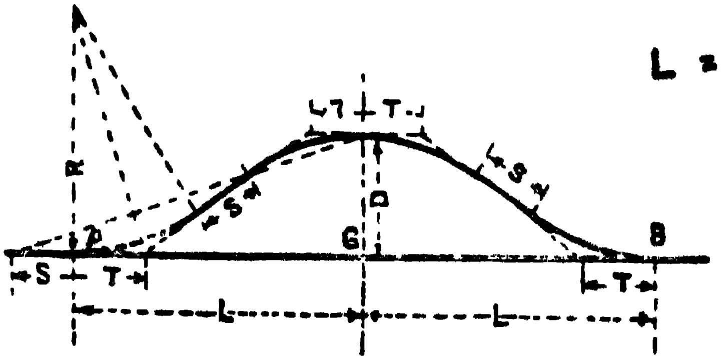
370. Diversions round obstructions are of two classes:—

Temporary,

Semi-permanent.

(*a*) The first are those required round an obstruction to traffic of any nature, which are not likely to be in use for more than ten days at the outside.

(*b*) The second are those made for the special purpose of alterations to the line and bridges, which are likely to be in use for a long period, as per sketch below.



$$L = \sqrt{S^2 + 4R.D - D^2}.$$

Symbols—

A-B—Portion of existing line to be diverted.

L—Length of half the diversion.

S—Straight portions of the diversion.

T—Tangents.

D—Maximum distance of diversion from Main line.

371. Temporary diversions are made hurriedly and opened as quickly as possible. On these it is necessary to "stop dead" all trains before entering the diversion and pass them over "dead slow" as long as the diversion is in use.

372. **Semi-permanent diversions are made at leisure and on diversions of this nature it will not be necessary to stop trains after the first week or such longer period as the Government Inspector considers necessary as by that time the road should have become properly consolidated and fit for a speed of 10 miles an hour.**

Addendum to page 106—

Para. 373-A (1.) At points where it is known from past experience that danger usually occurs it will be advisable to erect shelters for the use of watchmen who should be kept permanently at the points during the rains. In addition to the acetylene hand lamps which will be supplied, each patrol and watchman should be provided with a hand signal lamp, a case of fog signals and a couple of red and green flags for day use.

(2) Patrols and watchmen should be supplied with water proof ~~caps~~ capes which should be collected by the Permanent Way Inspectors at the end of the rainy season and re-issued the next year

(3) In cases where it is necessary to keep a considerable length of line under observation it will be best to erect a shelter at each end and appoint a patrol to go from one end to the other at regular intervals during the day and night

(4.) Arrangements should also be made for keeping a good supply of boulders at suitable places on the Division which can be got at with the least possible delay.

CHAPTER XVIII.

SINGLE LINE WORKING ON DOUBLE LINE.

Where there is a double line, every train must, unless special instructions otherwise provide, be run on the left hand side. General Rule 84.

Provided that, if one of the lines should be blocked so as to necessitate single line working, such special instructions as may be necessary shall immediately be issued for establishing single line working.

374. When single line working had been adopted owing to an obstruction Station Masters will give Drivers Caution Orders stating where the obstruction is, on which line the train is to run, also any restriction of speed which the Engineering Staff may find it necessary to lay down. For this purpose Station Masters will obtain information from the Officers of the Engineering Staff and pending their arrival must exercise a careful discretion.

375. When an accident or obstruction on the double line involves single line working over a portion of line on which a runaway catch siding is situated, no train shall be run over the catch siding in the direction facing to the points till the points have been disconnected from the lever and blocked or spiked over for the straight road and the Permanent Way Inspector shall have given an assurance in writing to the Station Master at one end of the section on which the catch siding is situated that this has been done.

376. Whenever an accident on the double line involves single line working, the person who is sent to rouse the cooly gangs must be specially instructed to warn them that such is the case and that Up or Down trains as the case may be must be expected on the wrong line.

CHAPTER XIX.

MATES AND GANGMEN.

Read General Rules Nos. 327, 328, 330, 331 to 342.

Records.

377. A register in form E 91 should be maintained of Mates and Keymen and submitted monthly to the Assistant Engineer for inspection. This is necessary, as several cases have occurred in which dismissed gangmen have been implicated in attempts to wreck trains.

378. Every mate or gangman and every other servant of the Administration, who is not a member of the Provident Fund, must on appointment have his name and other particulars recorded in a Service Card G 199A and after two years service on a service Card G 199, as laid down in Chief Auditor's Circular No. 189 of 7th September 1912, which Service Cards must be kept carefully up to date.

379. These service cards must be carefully preserved as they are the authority on which a gratuity is granted on retirement.

Safety of working gang.

380. During the passage of any train on a single line section the gangmen working on the line should stand in a row to the south or west of the line and at right angles to it on the bank between the cess and the boundary. On double line section, if the train is approaching on the line on which the gang is working, they should stand on that side of the bank, which is nearest to the approaching train.

381. On sections where the bank is higher than 10 ft. or where the grass is tall they should stand in a row along the top edge of the bank.

382. Accidents to gangmen very often happen while working near a curve or a cutting owing to their not being able to see an approaching train at a sufficient distance to enable them to clear away from the track in time.

To prevent such accidents occurring in future, when the gangmen are working at a place from which an approaching train cannot be seen from at least a quarter of a mile away, a flagman should be sent out

(*a*) On double line, in the direction of approaching trains,

(*b*) On single line, in either direction,

whose duty will be to warn the mate by means of signals when a train is approaching. The mate will be responsible for warning the gang in good time to enable them to get clear.

Collections of tools or Instruments.

383. Permanent Way Inspectors and Mates are held responsible for the safe custody of tools at all times whether in use or in store.

384. Mates must see that their lengths are kept neat and tidy and that no loose material is left lying about and that all is collected and brought in to stations, ganghuts or gatelodges.

385. When fencing repairs are being carried out all short pieces of wire should be collected and buried, as they are liable to be picked up by birds and dropped on the telegraph wires causing an interruption of communication. This is specially important in the vicinity of high tension electric power wires.

Interruptions to Telegraph.

386. In cases where interruptions to telegraph wires are due to obviously visible causes, such as a fallen tree fouling the wires, a broken wire, a fallen telegraph post, etc., it is the duty of the Permanent Way staff—as of every other servant of the Administration, who may observe the cause—to render all possible assistance in applying the proper remedy. The staff must remove trees or branches of trees which may foul telegraph wires after a storm and in cases where the wires are observed to be broken or entangled the occurrence should be at once reported to the nearest Station Master.

387. They must also render every assistance in their power in helping the Telegraph Department staff to reach the spot as quickly as possible

CHAPTER XX.

MUSTER OF GANGMEN.

Rules relating to Muster Rolls.

388. The muster sheet is the original document constituting the authority on which the dues of gangmen are paid. This original document has to be submitted to Audit for payment and no copy may be substituted even if the copy be strictly accurate.

389. The muster roll must be written up daily and a proper check kept on the attendance of the gangmen. Writing up muster sheets at the end of the month is absolutely forbidden and any Inspector who is found submitting muster rolls that have not been written up daily will be severely punished.

390. The muster roll will be maintained by the mate of each gang. He will be provided with a cylindrical tin case 14½" long by 2½" diameter with lid in which to keep his muster sheet and a blue chalk pencil with which to write up the muster roll. The muster sheet must always be kept by him on the work, so that it can be examined at any time by the Engineer or Inspector.

391. The general practice on the East Indian Railway is that the month for the purpose of muster shall be reckoned from the 16th of one month to the 15th of the next. On the 16th of each month the Permanent Way Inspector will take back the expired muster roll and will hand to each mate a fresh muster roll—Form G. 22—on which will be written up the names of his gangmen on that date. The muster roll will be taken twice daily, *i. e.*, in the morning and evening. In the morning the hour should not be later than 8 A. M. For those present in the morning a mark thus / will be placed against each man's name—for those absent the mark will be a zero thus O. If a man, who has been present in the morning, is not present in the evening the stroke against his name will be converted into a cross thus ×

392. The mate will also write at the top of the page the mileage and telegraph post where each day's work is done.

Check of Muster Sheets.

393. Every time an Inspector passes a gang he should stop and count the men, inspect the muster sheet and see that the absentees have been correctly entered as such. If the mate has not entered them as absent and can give no satisfactory explanation for not having done so he should be fined. Every time the Engineer or Inspector examines the muster sheet he should put his initials at the top or bottom of the column corresponding to the date on which the check was made with any remarks he has to make in regard to mistakes found in

same. It is preferable that the Engineer should put his initials or full signature in ink together with a note as to the number of men found present so as to be a check on fraudulent entries thereafter. Also that he should make a note in his pocket book and at the time of submission of muster rolls check these notes with the muster rolls submitted so as to prevent false, or forged muster rolls being passed.

The numbers of men present should be entered above initials of the Engineer.

394. There should be strict discipline about the mustering. If a man is not present he is absent unless it can be conclusively shown that he is engaged on legitimate work elsewhere. The excuse that a man has been sent off to the head quarter station of the Inspector to fetch wooden keys is not valid, as it is the business of the Inspector to see that these keys are supplied to the gangs and not for the gangmen to fetch them.

395. Similarly the practice of taking men from the gangs to take the place of absentees amongst trollymen should be discouraged if not absolutely forbidden.

396. On pay days the gangmen should be advised to be present. The responsibility of identifying each man rests with the Inspector and he should be vigilant to see that no one comes forward to impersonate one of his gangmen and to draw his pay. Each gangman must on drawing his pay affix his left thumb impression clearly on the muster roll against the amount drawn. No man may draw pay on behalf of another.

397. Particulars of wages remaining unpaid should be entered in Form E. 286 which should be submitted through the Assistant Engineer to the District Engineer or Superintendent, Way and Works.

CHAPTER XXI.

FOG SIGNALLING

398. In thick or foggy weather, whenever it is necessary to indicate to the Driver of an approaching train the locality of a signal, two detonators must be placed on the line, by a railway servant appointed by the Station Master in this behalf, about ten yards apart and at least one hundred yards outside the outermost signal of the station. (General Rule No 36.)

399. On the East Indian Railway the distance at which the detonators should be placed is 900 feet outside the outermost signal or in the absence of an outer signal 2,100 feet from the outer points.

400. When it is necessary to send a man from a station to put down fog signals he must carry a hand signal lamp, and according to the instructions he receives from the Station Master, will shew a danger signal if there is any obstruction or a green signal if the line is clear

401. In case it is necessary to keep a man out for any length of time he must be relieved every three hours.

402. Fog signals must be carefully handled as they are liable to explode if roughly treated.

403. No defective detonator or one which cannot be securely attached to the rail must under any circumstances be used.

404. Fog signalling is done by the staff working under the S. W. Works at the following stations :—

Howrah.
Lillooah.
Belur.
Bally.
Uttarpara.
Konnagar.
Rishra.
Serampore.
Sheoraphuli.
Baidyabati.
Bhadreswar.
Mankundu.
Chandernagore.
Chinsurah.
Hooghly.
Bandel Jn.
Trishbigha.
Magra Jn.
Talandoo.
Khanyan.
Pundooah.
Simlagarh.

Boinchee.
Debipur.
Bagila.
Memari.
Nimo Block Hut.
Rasulpur.
Balut Block Hut.
Saktighar.
Gangpur.
Burdwan.
Talit.
Khana Jn.
Asansol.

Grand Chord Line.
Chanch.
Dhanbad.
Kusunda.
Katrasgarh.

Palmerganj.
Sone East Bank.
Dehri-on-Sone.
Karmnasa.

Madhupur.
Simultala.
Jhajha.

Mokameh Ghat.
Mokameh Jn.
Bankipore.

Dinapore.
Moghalserai.

Mirzapur.
Allahabad.

Cawnpore.
Etawah.

Shikohabad.
Tundla.

Barhan.
Jalesar Road.

405. The names of men told off for fogging and their places of residence will be given to the Station Master by the Permanent Way Inspector.

406. The Station Master will daily submit a list to the Permanent Way Inspector of men who have been called out stating number of hours on duty.

407. The Station Master will call out the men when required and provide them with the necessary fog signals. He will also advise them when they can return from duty.

408. When the men are on duty for 5 hours or over they will not be required to work on the day following. When the men are on duty for over 3 and under 5 hours they will not be required to work for the first half of the day following.

When the men are on duty for less than 3 hours they will not be required to work for the first quarter of the day following.

409. The men will draw a night allowance of annas four if on duty for 5 hours or above and allowance of annas three if on duty for under 5 hours.

410. The Permanent Way Inspector will be responsible or instructing the men in the duties of fogging.

CHAPTER XXII.

RULES FOR THE WORKING OF LORRIES, TROLLIES AND MOTOR TROLLIES.

G. R. 342. Distinction between Lorries and Trollies.

411. (1) For the purposes of the following rules in this Chapter, a vehicle which can be lifted bodily from the line by four men shall be deemed to be a trolly, and any similar but heavier vehicle shall be deemed to be a lorry.

(2) A trolly shall not, except in cases of emergency, be used for the carriage of permanent way or other heavy material; and, when a trolly is so loaded, it shall be deemed, for the purposes of these rules, to be a lorry.

412. *Efficient Brakes.*—No trolly may be placed on the Line unless it has efficient brakes.

Marking of trollies.

412a. Each trolly must have marked an it a number, the designation and the code initials of the head quarter station of the person authorized to use it.

G. R. 343. Qualified person to be in charge of lorry or trolly when on the line.

413. (1) The Head trollyman should pass an examination in the trolly rules and be in possession of a certificate of having done so.

(2) No lorry or trolly may be placed on the line except by a railway servant appointed in this behalf by special instructions.

(3) Such railway servant shall accompany the lorry or trolly, and shall be responsible for its proper protection and for its being used in accordance with special instructions.

Persons authorised to use trollies.

414. Senior Scale Officers of the Operating and Engineering Departments not being Accounts or Store officers junior scale Engineers, Permanent Way Inspectors, Signal Inspectors, Block Signal Inspectors, and Inspectors of Works of the Engineering Department and such other persons of the Operating and Engineering Departments as are authorized by their Divisional Superintendent or Engineer-in-charge are permitted to use a trolly. Persons of grade not specified when using trollies must hold as authority a trolly pass issued by the competent authority. The use of lorries or trollies loaded with material is confined to the Engineering Department.

415. Every person authorised to use a trolly shall be held responsible that it is used by no other person whatever, except by his own immediate subordinates when on duty; and he shall be responsible for the conduct of his subordinates.

9A

Manning of Trollies and Lorries.

416. Trollies must in all cases be manned by persons experienced in the working of trollies.

Number of men to be provided for workin trollies or lorries.

417. Every trolly must be accompanied by not less than four men for working it.

(*a*) On single line every lorry or light trolly loaded with material must have 6 men with it, 2 of the men acting as flagmen.

(*b*) On double line the lorry being taken in the same direction as that in which the trains run there need be only 5 men, one acting as flagman to protect the trolly or lorry in the direction from which trains may approach.

(*c*) These additional flagmen must either be regularly taken on for the purpose when required, or they must be picked up from the gangs on the line; the person in charge of the trolly or lorry will be held responsible for carrying out this order and for seeing that at no period is he without the full number of men required for the efficient working and protection of his lorry.

G. R. 344. Attachment to train prohibited.

418. No lorry or trolly shall be attached to a train.

G. R. 345. Time of running.

419. A lorry shall ordinarily be run only by day, and when the weather is sufficiently clear for a signal to be distinctly seen from a distance of half-a-mile.

420. Under absolute necessity only shall lorries or trollies loaded with materials be run at night or in foggy weather or in dust storms. When such a proceeding is absolutely necessary, the person in charge of the trolly is personally responsible that special precautions are taken to prevent any avoidable risk from accident. When light trollies are run at night, or in thick or foggy weather, or in dust storms, in addition to the precautions laid down, extra vigilance must be exercised by the person in charge, and great care observed in running when a clear view for a full half mile required by the rules is not obtainable.

Red flag or light to be shown.

421. Every lorry or trolly when on the line must show a red flag by day and a red light by night in the direction from which any train may come.

Signals for trollies.

422. No trolly shall be placed on the line unless provided with both day and night signals and a chain and padlock for securing the trolly when removed from the line. The day signal is a red flag fixed to a staff placed perpendicularly in a socket so as to be conspicuously visible. The night signal is a light similarly placed and showing on the double line red in the direction from which trains are to be expected and white in the other direction, and on the single line red in both directions. The fixed signals are always to be exhibited whilst a trolly is standing upon or running on any line. Hand signals for both day and night use should always be carried on the trolly to be used as directed. Hand signal lamps should be kept lighted at night time.

Protection of trolly on the line.

423. The railway servant in charge of a trolly shall, before leaving a station, ascertain the whereabouts of all approaching trains, and shall, when a clear view for an adequate distance—

(*a*) On a single line or within a 'yard' in both directions or

(*b*) On a double line, in the direction from which trains may approach,

is not obtainable, take such precautions for the protection of his trolly as may be prescribed by special instructions.

424. When a trolly is leaving any station, intimation shall be given to the occupants on their application of the running of special trains or light engines. Persons in charge of trollies are responsible for making themselves acquainted with the running of special trains or light engines.

Protection of lorry on the line.

425. (1) Whenever it is proposed to place a lorry, whether loaded or empty, on the line, the line shall, if it is possible to do so without interference with the working of trains, be blocked under the rules for working trains.

426. (2) When the line has not been so blocked, and a lorry, whether loaded or empty, is placed on the line, the lorry must be protected.—

(*a*) on a double line, by a man either following or preceding the lorry at a distance of not less than half-a-mile in the direction from which trains may approach, and plainly showing a Danger hand signal; or

(*b*) on a single line, by a man following and a man preceding the lorry at a distance of not less than half a-mile and plainly showing a Danger hand signal;

and the men so following or preceding the lorry—

(*i*) must be furnished with detonators, and must place three on the line, ten yards apart, immediately the lorry comes to a stand for the purpose of either unloading or loading, and

(*ii*) must continue to show the Danger hand signal and keep the detonators on the line until a messenger arrives with an order from the Ganger or other person in charge of the operation to withdraw the signal, and

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EAST INDIAN RAILWAY.

Engineering Department Manual.

Addendum Slip No. 15.

In 3rd line of para. 427, page 117 after "in charge of an Engineer" *add* "Inspector, Assistant Inspector, Sub-Inspector or Head Mistry" and in the 7th line Before "Inspectors" put "Engineers" and after "Sub-Inspectors" *add* "and Head Mistries."

CHIEF ENGINEER'S OFFICE, *Calcutta*, 18*th September*, 1929.	A. C. DUNSDON, *for Chief Engineer*.

W. O. No. 2864—1,500—23-9-29.

[illegible]

428*a*. All inspection lorries and trollies must give way to trollies loaded with materials.

429. On those portions of the line where, owing to curves in cuttings, or other causes, the view of the line from a running trolly is limited to less than half a mile, trolly signal stations

Trolly signals

NOTE.—All the provisions of this rule apply to lorries or light trollies when loaded with materials or when run at night or in foggy weather or in dust storms.

are established at sites commanding a good view in both directions. The signals consist of a ball or revolving disc on a staff of suitable height. The raising of the ball or the exposure of the disc to an approaching trolly indicates that no engine is in sight on the line the ball or disc refers to. The rapid raising and lowering of a ball signal or the turning on and then off of a disc signal repeatedly indicates a train is approaching and the trolly should be cut off the line immediately. No trolly must pass a trolly signal till signalled past, except when it can follow a train and keep it in sight. Trolly signals are intended for day working only.

430. The signalman, before raising the ball or turning the disc to let a trolly pass, must be certain that no train or engine is approaching. On the disc turned in the absence of signal stations on a single line, one man shall precede and one man follow the trolly at an interval of 400 yards, carrying and displaying danger signals in both directions. On the double line signals shall be similarly displayed in the direction from which a train may be expected.

Securing of lorries and trollies.

431. A lorry or trolly, when not in use, must be placed clear of the line, and the wheels must be secured with a chain and padlock.

Carrying of trollies.

432. No trollies are to be carried by Mail trains except in case of an accident or of great emergency.

433. Trollies can only be carried in the Brake Van of Passenger, Mixed, and Goods trains provided there is room, and that when being so carried they will not cause damage to the other contents of the van, or inconvenience and delay the Guard in checking and delivering luggage, parcels, &c.

434. Trollies must not be loaded into District Road Vans on a Van Goods train.

435. When conveyed by Goods train, the trollies must be loaded in a truck or wagon if there is one on the train available, and the trollymen must ride with the trolly.

436. No trolly must be loaded up into any vehicle of a train without the consent of the guard in charge of the train, who will direct where it is to be placed, and Inspectors and others requiring their trollies to be placed in trains must give notice of the same to the Station Master previous to the arrival of the train.

437. When there is room in a train the Guard must not refuse to receive a trolly unless it be a Mail train.

ADDITIONAL RULES FOR MOTOR TROLLIES.

438. The following are authorized to use motor trollies:—

Senior scale (and Junior scale when authorized) officers of the Operating and Engineering Departments not being Accounts and Stores Officers.

Persons authorised to use Motor Trollies.

Block Signal Inspectors.

Signal Inspectors.

(*a*) Senior scale Officers in their discretion may allow their Assistants to use their Motor trolly.

EAST INDIAN RAILWAY.

Engineering Department Manual.

Corrigendum Slip No. 16.

In the 1st, 2nd and 3rd lines of para. 440, page 119 for "Motor Trollies ... ... 6 persons" *substitute* the following:—

> "Motor trollies must be manned by 5 to 6 selected trollymen, according to the Type of trolly used, and the load must in no case exceed 7 persons, when passengers are carried the total number of persons must be kept within the limit of 7 by putting off a trollyman."

CHIEF ENGINEER'S OFFICE,
Calcutta, 23rd September, 1929.

A. C. DUNSDON,
for Chief Engineer.

W. O. No. 2865—1,500—25-9-29.

Kanspur Gugauli—Karbigwan.
Chakeri—Panki.
Kanchausi—Phaphund.
Achalda—Samhon.
Ekdil—Sarai Bhopat.
Kaurara—Shikohabad.
Araon—Shikohabad.
Makkhanpur - Firozabad.
Harangau—Mitawali.
Tundla—Kuberpur.
Jumna Bridge—Agra Fort.
Jumna Bridge—Agra City.
Hathras Branch.
Daud Khan—Aligarh.
Khurja Junction—Khurja City.
Maripat - Ghaziabad.
Beohupur—Benares Cantonment.
Badshahpur—Jagesharganj.
Bachhrawan—Nigohan.
Utraitia—Dilkusha Cabin.
Lucknow—Kakori.
Dilawarnagar—Sandila.
Dalelnagar—Balamau.
Hardoi—Kaurha.
Rosa—Banthra.
Miranpur Katra—Fatehganj.
Rasuiya—Maheshpur Utraitia.
Dhanata—Nagaria Sadat.
Rampur—Mundha Pande.
Dalpatpur—Moradabad.
Bundki—Chandok
Balawali—Roorkee.
Baliakheri—Saharanpur.
Zafarabad—Jaunpur.
Kheta Sarai—Shahganj.
Ajodhya—Fyzabad.
Baragaon—Rudauli.
Rasauli—Barabanki.
Malhaur—Dilkusha Cabin.
Aonla—Karengi.
Chandausi—Bahjoi.
Harduaganj—Aligarh.
Khajurhat—Chilbila.
Partabgarh—Allahabad.
Zafarabad—Mariahu.
Janghai—Phaphamau.
Rae-Bareli—Daryapur.
Barabanki—Bindaura
Balamau—Madhoganj
Balamau—Misrikh.
Sitapur City—Sitapur Cantonment.
Lucknow—Amausi.
Jaitipur—Sonik.
Unao—Cawnpore.
Hardwar—Dehra Dun.

Kankhather—Garhmukhtesar.
Babugarh—Hapur.
Pilkhuwa—Ghaziabad.
Najibabad—Kotdwara.
Raja-ka-Sahaspur—Moradabad.

442. On the following double line sections motor trollies shall be signalled on the block instruments:—

Patna—Bankipore.

Ghaziabad—Subzimundi.

The electric bell signal for a motor trolly is ●●- ●●● ●●●●.

443. Paras ~~443~~ 441 and ~~444~~ 442 do not apply when a motor trolly can follow directly behind a train and keep it in sight. In such cases an interval of not less than 200 yards should be kept between the trolly and the train.

444. On other sections of the line the person authorized to use a trolly may ask for and receive a line clear: but in that case he will be responsible for any detention which may be caused to trains thereby.

445. When junior officers are lent a motor trolly by their District Officer, they shall invariably run on the block or on line clear, tablet or token, except when, on the double line, they can keep signals constantly in sight or except as provided in Para. ~~445~~ 443

446. When it is necessary for a motor trolly to run between the hours of sunset and sunrise, or during fog, or a dust storm, it shall invariably run on the block or on line clear, tablet or token.

447. After ascertaining the running of ordinary trains the person in charge of a motor trolly running on the sections
441 named in Paras ~~443~~ and ~~444~~ shall advise the Station Master of 442
the station where he receives his authority to start, in writing, how long he expects to be in reaching the next station. If the line is clear, and no Mail or Passenger train will be detained by permitting the motor trolly to run, the Station Master will issue the authority to proceed to the person in charge of the Motor Trolly in the following form:—

> "Your are authorized to proceed with Motor Trolly No.............
> "to..........The line between.................. and.................. will
> "be kept clear for your Motor Trolly from......................h..........
> "m to................ h ....m after which trains will be allowed
> "to run, as usual, on the section."

(*a*) **The Station Master giving such a guarantee, at the time of giving it will make an entry in the train Signal**

Register to the effect that the section referred to is to be kept blocked for the time specified thus:—

"Line to .... station has been blocked from.....................
"h...............m to...............h...............m for Motor Trolly,"

and this entry must be signed (not initialled only) by the person in charge of the trolly.

(*b*) The person in charge of a motor trolly will be responsible for piloting himself into a station from the first stop signal.

Detention of trains by mottor trollies.

448. Trains carrying passengers may not be detained for motor trollies nor may goods trains be detained more than five minutes for a motor trolly.

Break down during journey.

449. In case of a complete break down of the trolly (*i. e.*, so that the trolly cannot be propelled even by hand) the person in charge of the motor trolly will have it removed from the line at once and will take steps to advise the nearest Station Master that the trolly has been cleared from the line.

(*a*) On receipt of this advice the Station Master will wire the station at the other end of the section advising him that the trolly has been removed. The motor trolly cannot be put on the line again until after the procedure given in Para. 449 has been complied with.

450. If the break down is not complete, the person in charge of the trolly will disconnect the driving gear and remove the keys of the wheel bearings so that the trolly can be readily removed from the line and he will proceed to treat the trolly as a material trolly and take the precautions laid down in General Rules 348 (1) and (2).

Motor trolly where to stop.

451. Motor trollies should, as far as possible, be stopped only on level crossings or other places where they can be readily removed from the line, but a motor trolly should not be run, while a train is approaching and is only a short distance off, in order to reach such a place.

Direction of running.

452. On the double line motor trollies shall, except within station limits, run in the same direction as the trains.

Responsibility for use.

453. Nothing in the foregoing rules shall relieve the person in charge of a motor trolly from the responsibility of keeping out of the way of all trains.

Responsibility for damage.

454. Should a trolly be damaged or destroyed through the rashness of the responsible official in charge, such official shall be liable to cost of repairs or replacement.

Additional rules for use of private trollies.

455. In every case where permission has been granted to the manager or employé of Mill, Coal or other Company to officer of the Telegraph Department to run a trolly on the railway within the prescribed limits, the head trollyman in charge of the trolly must be a qualified trollyman holding a certificate from the Engineering Department certifying him as qualified for the charge; he will be authorized under General Rule 343 to place the trolly on the line and be held responsible for its proper use and protection. The Head trollyman will be a railway servant; but his salary will be received from the Company concerned.

456. A trollyman appointed to have charge of a private trolly must be provided with a copy of the General Rules and Subsidiary Rules together with any special orders relating to the working of the trollies on the section of the line to which the private trolly license applies, and must sign an acknowledgment in the prescribed form (appended) that such rules and orders are in his possession and that he is acquainted with them.

SPECIMEN FORM.

I employed in the service of the East Indian Railway as a trollyman in charge of the private trolly and holding a certificate of qualification from the Engineering Department of the East Indian Railway hereby acknowledge that I have received and had explained to me, for my information and guidance, the General and Subsidiary Rules, appertaining to the working of trollies on open and private lines.

I do hereby affirm that I am thoroughly acquainted with the requirements of the above orders, and should I commit a breach of same that I am liable to a criminal prosecution.

As witness my hand this day of One thousand nine hundred and

Signature

Address

Signed in the presence of

457. The private trolly pass must be kept by the Head trollyman and shown when required by the Station Master or other official of the railway.

458. When not in use the trolly must be kept in the custody of some responsible person clear of all railway lines. The wheels must be chained and padlocked, the key being kept in charge of the certified trollyman.

459. In the case of private trollies the designation of the person or the Company authorized to use the trolly must be painted on the front and back of the trolly in clear black letters on a white surface. Such trollies are to be used during day light only.

CHAPTER XXIII.

TRAIN SPEEDS.

460. The following are the speeds permitted through facing points on the East Indian Railway :—

Through padlocked points ...	10 miles per hour.
Through points fitted with Dutton's key lock on the straight	25 Ditto
Through interlocked points ... on the straight.	40 miles per hour.
Through facing points where the train takes the turnout	10 miles per hour.

For engines running tender foremost the speed must not exceed 5 miles per hour.

460 (*a*). The speed of trains must not exceed 10 miles per hour at stations where the main or through line is not isolated from all other lines.

(*b*). The speeds of trains on the main line and branches, etc., is laid down in the working time table.

CHAPTER XXIV.

BALLAST TRAINS.

Running at night and during fog.

461. Ballast trains not containing Ballast coolies are authorized to be run through from one station to another after dark, during a fog or during heavy rain, when protected by the prescribed lights but must not under any circumstances stop to work on the road. Such trains should be treated in every respect as ordinary Goods trains running at 15 miles an hour.

462. A Ballast train containing Ballast coolies must not be allowed to proceed more than 19 miles on its journey to destination after sunset, that is, if the station where the train would under ordinary circumstances remain for the night, is 20 miles or more distant at sunset, the train can only proceed to the next station and not beyond.

463. No Ballast train shall be allowed to work on the line during fog.

Running through.

464. A Ballast train, when running through from one station to another without stopping on the Road, will run under the same rules as a Through Goods train, and in strict accordance with the system of working in force on that part of the line on which the train is working, and while giving way to Mail, Passenger and Fast Goods trains should not be detained unnecessarily. On the Single line, a Ballast train Guard before starting should write across the counterfoil of the Line Clear Authority that he intends going through without stopping.

465. When a Through Ballast Train is due to start from a Changing station, it should be allowed to leave before a Through Goods train and not behind it, so that the train may experience as little delay as possible, as being a lighter train than a through goods it may be expected to get through more quickly.

Treated as Through Goods.

466. Unless intimation has previously been received that a Ballast train is going to work on the line, the Station Master receiving a "Train entering Section" or Enquiry message concerning a Ballast train, will assume that the train is running through and will treat it as a Through Goods train.

467. When there is only one Brake-van with a Ballast train it must be so marshalled that it will be in its proper place at the end of the train leaving a station, and the Guard in charge of the Ballast train will be held responsible that this is done.

468. A Ballast train may, when necessary, be pushed by the engine between stations at a speed not exceeding 15 miles per hour.

469. No Ballast train working on the Double line is to return on the same line, to the station from which is started, but must go on to the next station and return by the proper line.

470. Ballast Guards are responsible for the protection of their trains.

471. Block Huts are not to be considered as stations by Guards of Ballast trains, as they cannot give way to other trains at Block Huts.

Issue of caution orders.

472. A Ballast train when intended to stop between stations will run on a Caution Order from the Station Master in which it must be distinctly stated:—

(1) That the train is to work on the line between the station issuing the Caution Order and the next station.

(2) The station at which the next train is to be passed.

(3) The time at which the Ballast train is to be in and shunted at that station.

473. Every Guard of a Ballast train, which has work to do or which has done work at a station, will send to the Station Master a printed advice in Form E. 223 stating at what time he will be ready to leave and noting on it the time the advice is sent. Before detaching the top copy of the advice the Station Master will note in pencil with carbonic paper underneath, the time the advice is received and that at which his reply is sent. He will also write his reply stating what arrangement he has made for the Ballast train to leave. He will then keep one copy and return the other in the book to the Ballast Guard.

474. Station Masters and Ballast Guard must accept Mail and Passenger trains as running to time unless they have received intimation that they are running late.

475. Station Masters will be responsible for any delay occurring to an ordinary train owing to a wrong time being shown on the Line Clear Authority, or order given to the Guard of a Ballast train, and should accordingly make liberal allowance in the case of a train running late for time likely to be made up either on the road or at stations. Time made up on the road under Locomotive rules may not exceed half a minute per mile.

476. On the Double line, a Ballast train intending to stop between stations will run on a written order from the Station Master.

On this order it must be clearly stated at which station the next train is to be passed, and the time the Ballast train is to be in that station and shunted; the Guard will sign for this order.

Advise of work.

477 On closing work for the night, the Ballast Guard after consultation with the Station Master concerned is to give the Station Master of the station at which he is stabling for the night, a written application for permission to start at a certain time the following day, stating in it where the train is going and if working or running through At the same time the Ballast Guard is to telegraph to the stations between which he intends to work the next day and advise them.

Ballast sidings.

478. There are Engineering Department Ballast sidings at the following stations :—

Pakur.
Maharajpur.
Jamalpur.
Bodma.
Mile 195½ Giridih Branch.
Damudarpur near Dhanbad station.
Jherriah Branch mile 157½ near Chhota Ambona.
Manpur.
Ramsila.
Jakhim.
Chunar.
Naini.
Allahabad.
Jhanghai.
Pratabgarh.
Gauriganj.
Bachhrawan.
Ajgain.
Hardwar.
Pathri.
Sukhrao River between Saneh Road and Kotdwara.

Protection of trains stabled for the night.

479. When a Ballast train with coolies is stabled at a station for the night it must be protected in the following manner

(*i*) The Guard in charge of the train must see that all necessary points connected with the siding on which the train is stabled are correctly set against the train, and must then inform the Station Master in writing that he has done so, and, until the train is ready to start,

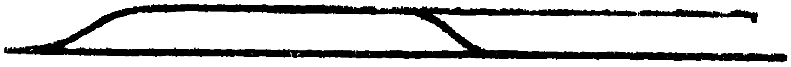
(*ii*) if the station is not interlocked, must padlock all necessary points connected with the siding on which the train is stabled and keep the keys in his possession, or

(*iii*) if the station is interlocked, must tie a red flag on the lever handle working the points; and

Manual for Engineering Department.
Addendum Slip No. 6.
Page 129, *Para* ~~430~~ 471 *A.—Insert a new para:—*

The inlet points to all sidings in which ballast trains are likely to stable at any time, should be provided with a hole through the stock rail and switch to permit of a locking bolt being used for securing the points with nut and cotter.

CHIEF ENGINEER'S OFFICE,
Calcutta, dated 26*th February* 1929.
W. O. No. 1806—1,500—4-3-29.



* Ballast train may be stabled in the dead end siding.

481. Guards of ballast trains must remain in charge of their trains so long as coolies are in the trucks or any shunting is to be done and they must be especially careful that all the coolies are seated on the floor of the trucks while shunting is being carried on. The Guard is responsible that no coolies take rest or shelter beneath wagons or close alongside the track, and must insist on the driver giving two clear whistles at an interval of half a minute as a warning to the coolies that the train is about to move. Shunting responsibilities.

482. A Jemadar is attached to every Ballast train whose duty it is to take charge of the train at night to see that no coolies remain under wagons, and generally to keep a watch on the train.

483. Each train must carry a sufficient number of tarpaulins or tents (Pals) to afford shelter for the night to all coolies working on the train. The Engineer-in-charge of the Division is responsible for seeing that sufficient shelter is provided for coolies.

484. When the labour on a train is supplied by a contractor on daily rates of pay, the Guard must muster this labour and send a telegram to the Assistant Engineer before 8 o'clock each morning stating the numbers present. Should Labour check.

any change in the numbers take place in the course of the day, the Guard should promptly send another telegram giving the amended number.

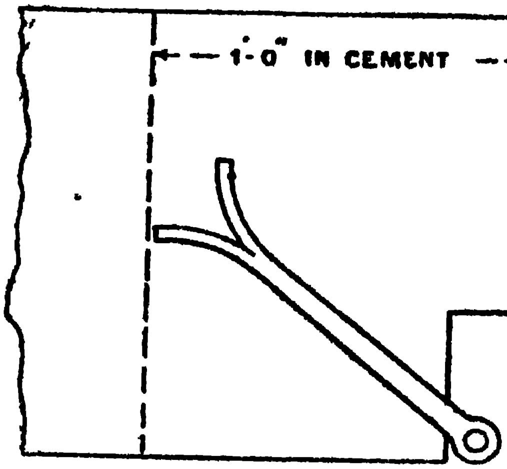
485. The Assistant Engineer should take every opportunity of personally counting the labour employed on the train and checking this with the Guard's telegraphic report.

486. The Assistant Engineers must bear in mind that it is an important part of their duties to see that ballast trains are expeditiously and economically worked, and this can only be done by planning out the work beforehand and seeing that this is carried out.

CHAPTER XXV.

STATION AND BUILDINGS.

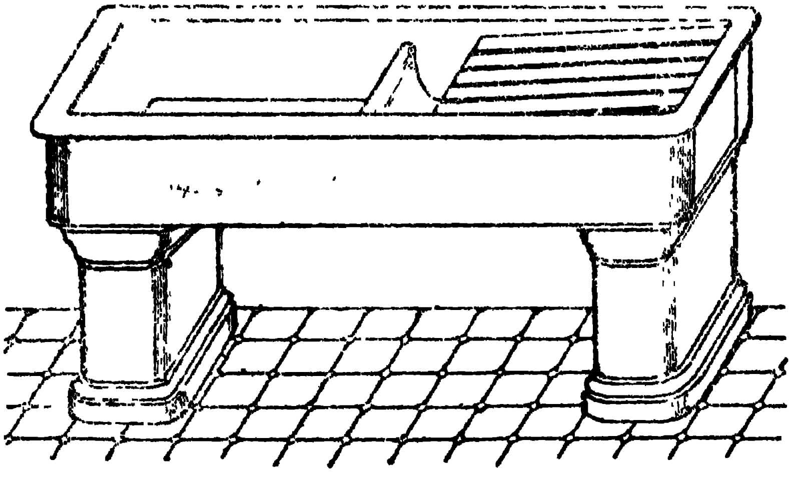
487. No choukhats are required for clerks, menials' quarters and such like structures; a half brick reveal should be left and hooks built in. The jambs for the entire height and about 1 foot in width being built in cement.

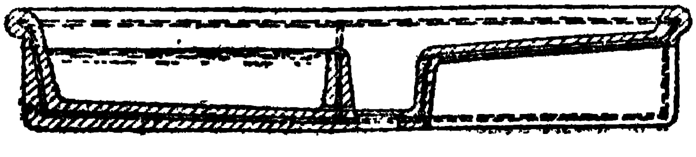


488. Where there is a difficulty owing to damp walls in waiting rooms, &c., a dado of cement plaster with Ironite 4′—6″ high should be made.

489. At refreshment rooms sinks with water supply should be provided in the scullery for washing up plates and dishes. The sink may be made of cement, or of slate or of wood lined with zinc, or of any other material found suitable. From the sink there should be a proper escape for waste water.

A useful type of sink made in concrete is illustrated belew.





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490. At waiting rooms the windows should be provided with ground glass up to a height of about 6 ft. 6 ins. above floor level. For bath rooms all the glazing should be done with ground glass.

491 Attention is directed to Chief Engineer's Circular No. 45, dated 7th July 1899 from which the following para. is quoted:—

> "The points noticed should of course have immediate attention, but in addition to these matters the state of the room generally must be looked to—the walls—the floor—the doors and windows—the *punkhas*,—etc., etc. We do not want luxury in a waiting room, but (especially in a country like India) we should have neatness, cleanliness and good order. The things, if plain, should be good of their kind and kept in propor repair, and generally in a fit state.

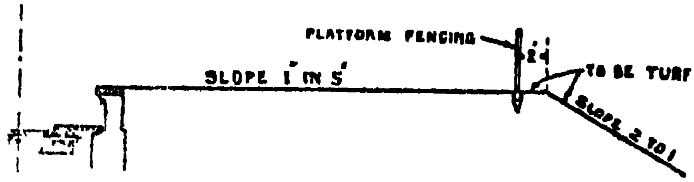
492 Brick buildings are to be neatly finished and pointed Outside walls are in no case to be plastered without special orders.

493. Pointing for stone masonry to be merely a sunk line. There is to be no projecting rim or ridge of mortar.

The finish of all masonry and brick work should be in accord with the best English style for work of that class. Bengali peculiarities in pointing and fancy plaster work are to be strictly suppressed.

Berm outset platform fencing

494. It is noticed that, at some stations, the slope at back of platform begins at the fence or even inside it The result is that the fence is difficult to maintain and has not proper support. A berm of 2 feet should always be maintained outside the platform fence (*see sketch*) and this berm and the slope below it should be protected by turfing.



Platform wire fencing.

495 Where wire fencing is used on platforms, proper corner posts and end posts should be provided (*see Chief Engineer's drawings Nos.* 24340 *and* 24342) to enable the wires to be strained tight.

Coping

496. For copings to new platforms where the stones delivered are of different lengths, they should be sorted out, the longest and best stones being placed opposite the station building and the shorter stones towards the ends of the platform.

Old tank houses.

497. At ends of platforms at many stations on the line there are old arched tank houses which infringe standard dimensions and obstruct the view from the platform along the line. Every opportunity should be taken to remove these old tank houses, many are out of use and might be removed at once.

Rail level platform.

498. Rail level platforms *when finished* should slope away from the rails with a fall of 1 inch in 5 feet. Where the bank is high, however, a new platform will have to slope towards the rails when first made, to allow for settlement.

Raised level platforms should slope from the centre to coping whenever possible to allow ready drainages of platforms. The slope should not be less than 1 in 60.

493, Where a platform is at rail level the position of front of platform is to be marked by a line of dressed stones, brick-on-edge or brick-on-end let in flush with the surface of the platform and at a distance of 5 feet 6 inches from centre of adjacent track.

500. At small passing stations, or flag stations, with rail level platforms, where only a small traffic is expected, the platforms may in the first instance be made of an *effective* width of 16 ft. (*i. e.*, 21 ft. 6 ins. centre of track to fence) plus the berm of 2 feet. The station building must however always be set back to the full distance, *i. e.*, 30 ft. 6 ins. centre of track to nearest part of building when tracks are spaced 15′—6″ centres.

Note.—If the track are spaced less than 15′—6″ extra space must be added to the 39′—0″ to allow for subsequent slewing of track to 15′—6″.

Joists and Bulb Tee Bars, for roofs, floors and similar purposes.

501. The safe distributed load in cwts. per foot run on the joists may be taken as shown in Table No. 1.

Table No. 1.

Joists.	Spans in feet.															
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.	Cwts	Cwts.	Cwts.	Cwts.
12″ × 5″ × 32lb. per ft.	147	102	75	57	45	36·5	30·8	25·7	21·5	18·8	16·2	14·7	12·7	11·2	10·1	9·1
9″+4″ × 21lb. per ft.	71·0	49·3	36·2	27·7	21·9	17·7	14·6	12·3	10·5	2·0	7·9	..		..	.	
6″ × 3″ × 13lb. per ft.	27	18·7	14·0	10·8	8·4	6·6	...	...	...	...	..	...	...	.	...	...

502. Before ordering joists and tee bars for floors and roofs a plan is to be made showing the joists and rafters, in which each room is to be separately studied with a view to spacing the joists and rafters as economically as possible.

503. No structural alterations are to be made to any building without Chief Engineer's sanction even when such alterations might not require sanction on the ground of expenditure

504. When sanction was obtained to provide screen walls to menials' quarters, it was on the understanding that jaffory work, *kutcha* walls and other untidy structures would no longer be permitted. Engineers are requested to have such unsightly additions removed, and not to allow them to be put up in future.

Petty repairs to Buildings, platforms, Staff Quarters, etc.

505. Petty repairs to Buildings, platforms, Staff Quarters, etc.

(1) Each Station or Running Shed Foreman will maintain a Petty Repair Book in which he will enter all requisitions for petty repairs including painting and whitewashing, etc., necessary in any of the buildings or staff quarters under his control.

(2) Only repairs and replacements of a routine or petty nature are to be entered in the book, and nothing in the nature of an addition or new supply is to be included.

(3) The Petty Repair Book will have four columns to a page, the first, (a narrow one) for date, the second (wide) for particulars of the work required, the third (wide) for remarks by the Engineering Staff, the fourth (narrow) for the date of completion of each item asked for.

(4) $\frac{\text{Station Master}}{\text{Running Shed Foremen}}$ will be responsible for showing the book to Engineering Inspector concerned, as often as may be necessary, and the latter will be responsible for seeing that no entry in the book remains unreplied to.

(5) The replies will either be "will be done" in ordinary cases, or "referred to Assistant Engineer" in cases of large jobs beyond the resources of the Inspector, or where the matter is not petty and seems to need reference, or "not a repair" where the work cannot fairly be classed as a repair. The Engineering Inspector will sign and date the book each time he examine it, and will fill up the completion dates of any previous items.

(6) Traffic or Loco. Inspectors will see that any petty repairs found necessary at their inspections, are duly entered, with dates, in the book. And they will only report such items to Divisional Superintendent for action when they have been entered in the Petty Repair Book and have remained unattended to for an undue time, or have been refused as in para. 5 above.

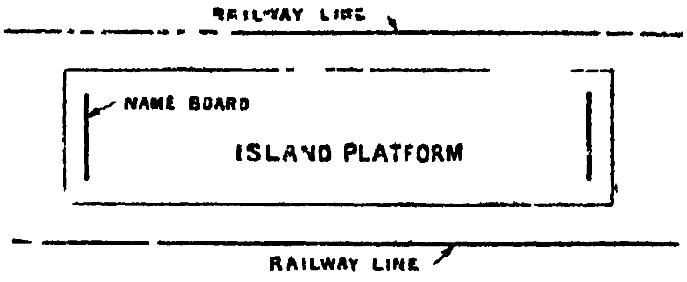
(7) The Assistant Engineers will inspect the Petty Repair Books at frequent intervals. They should report any unnecessary repairs asked for and should see that their inspectors are dealing promptly and correctly with requests for repairs.

They should sign and date their inspections of the Petty Repair Books.

Name Boards at stations.

Name Board at Stations

506. On platforms Name Boards should be right angles to the rails at either end of the platform, painted on both sides and as far back from the rails as possible.



EAST INDIAN RAILWAY.

Engineering Department Manual.

CORRIGENDUM SLIP No. 8.

In place of the words "Traffic or Loco. Inspectors" in clause 6, para. 505, page 134 of the Engineering Department Manual, *substitute* the following words:—

"Transportation Inspector, Power (P. T. I.)
Transportation Inspector, Movement (M. T. I.)
Transportation Inspector, Commercial (C. T. I.)"

CHIEF ENGINEER'S OFFICE,
Calcutta, dated 22*nd May* 1929.

A. C. DUNSDON,
for Chief Engineer.

W. O. No. 742—1500—24-5-29.

CHAPTER XXVI.

COLOUR, WASH AND PAINT.

Standard colours.

508. The standard colours to be used on this Railway for station buildings, platforms, doors, etc., shall be shades of yellow ochre. For paint there will be two shades and for colour wash one shade.

The constitution of the paint and colour wash is as follows:—

Colour wash.

One coat of white wash and two coats of colour wash are standard.

Colour coat.

00 S ft.

Chalk	5 lbs.	Covers 100 S. ft.
Glue	2 ozs.	
Yellow ochre, dry	1 oz.	

Paint.

Dark paint.—Approximate quantity for say one gallon mixed paint.

nt for wood works and Steel Structures not girders.

Yellow ochre, dry	5 lbs.	Covers 300 S. ft. 2 coats which is standard.
Red oxide, dry	11 ozs.	
Burnt umber, dry	3 ozs.	
White lead, mixed	1 lb.	
	G. q. pt.	
Boiled linseed oil	1 0 1	

Light paint.—Approximate quantity for 1½ gallons mixed paint.

White lead, mixed	20 lbs.	Covers 450 S ft. 2 coats which is standard.
Yellow ochre, dry	1 lb.	
Burnt umber, dry	⅝ oz.	
Red oxide, dry	1¼ oz.	
Boiled linseed oil	1 gallon.	

One gallon mixed paint will cover 300 S. ft. two coats.

Painting steel work on girders.

For painting bridge girders and other iron and steel structures red lead and boiled linseed oil should be mixed in the proportion by weight of 4 parts of red lead powder to 1 part of boiled linseed oil. Mixed in these proportions it will be found practically that one gallon of mixed paint requires 28 lbs. of red lead powder and three quarters of a gallon of boiled linseed oil. The paint is to be well ground in a paint mill immediately before using.

No other paint is to be used on bridges.

The oil and red lead should conform to the following specifications :--

Specification.

Red Lead --Red lead is to contain at least 25 per cent. of lead peroxide and not more than ·5 per cent. of foreign matter and is to be free from all organic colouring matter.

Linseed Oil

Boiled (double-boiled) :—

The oil is to be prepared from genuine linseed oil and the necessary driers only. On analysis it is to give results between the following limits :—

Specific gravity at 30° C. /30° C.	...·929—·941
Saponification value ..	... 189—196
Acid value ...	. not more than 6·0

A glass plate coated with the oil will be suspended in a vertical position until the oil dries. This test will be carried out in the shade and under free circulation of air. The oil should dry within 8 hours and give a firm, elastic film free from stickiness.

Immediately before repainting iron and steel work the old painted surface must be thoroughly cleaned to remove all loose and perished paint, and the prepared surface must be examined and passed by an Inspector before repainting is commenced. The use of caustic soda for cleaning bridges should be forbidden. To ensure adhesion to the prepared surface hot boiled oil is then to be applied while the surface is clean and dry and before any oxidation has had time to commence. This is to be followed by two coats of red lead paint. The coat of hot boiled oil and the first coat of paint must both be dry and hard before the next coat of paint is put on. Painting is not to be done during the rainy season or when there is any moisture on the surface to be painted. If possible it should be done while the surface is warm from sunshine.

The surface covered per gallon of oil paint is as follows :—

Material.	Volume.	Square feet.	
		1st coat.	2nd coat.
Boiled linseed oil (new pigment.)	1 Gallon..	800	....
Paint	1 " ...	450	720

A record should be kept in the District or Divisional Engineer's Office of the dates of painting iron and steel bridges and structures and the kind and quantity of paint used in each case, and these dates should be recorded on also when each span is repainted in white lettering.

509. New brick work is not to be colour washed.

510. In wood work the frames will be of the darker colour and panels of the lighter. In ironwork of roofing the lighter colour will be used picked out with the darker shade.

511 When repainting a building or on any new work these colours must always be used in future. Thorough repairs to buildings are to be considered triennial as a rule.

(*a*) In painting stations palings the supports and horizontal members should be painted with a darker colour and pales with lighter colour. Alternate light and dark streaks should not be employed any where.

CHAPTER XXVII.

WEIGHBRIDGES AND CRANES.

Weighbridges.

512. Water in the sump must be removed by the Traffic staff, but in cases where no pump is provided for that purpose, the Permanent Way Inspector at the request of the Weigh Clerk will remove the water.

513. In the construction of weighbridge pits natural drainage should be secured if possible. When this is not possible every care should be taken to make the pit as water tight as possible. The concrete in the floors and the masonry of the walls should be built in cement or waterproofing should be applied to the *outside* of the walls. It is not usually sufficient to plaster the inside walls with a coating of cement. Care should also be taken that surface water does not make its way down into the pit.

Working of cranes.

514. Cranes must always be worked by trained sets of men under a properly qualified craneman. When a crane is lent by one Department to another, it must be accompanied by a duly qualified craneman and worked under his directions, the remainder of the gang being found by the department using the crane such department being held responsible that the crane is worked only under these conditions.

515. The man in charge must thoroughly examine the crane and is responsible that the Balance Box is properly filled and adjusted before any lifting is commenced.

516. The Balance Boxes should be filled with cast iron blocks of uniform size, having their weights stamped on them; and not with odd lumps of cast iron scrap. Balance Boxes not at present properly fitted should be properly furnished as soon as practicable.

517. The weight in the Balance Box must on no account be reduced when lifting light loads, but must always be kept at its maximum. The boxes must also be fixed at the end of the trail.

518. Should the weight to be lifted exceed one-half of the total weight the crane is guaranteed to lift, the truck must be secured to the rails by "claws" with which all cranes must be fitted.

519. The "claws" or "grippers" must grip the rail and must each be secured by a one-inch bolt and nut. The scissor style and the gripper with inclined planes and sliding securing band are useless. Cranes at present so supplied should be refitted.

520. The cranes must be supplied with levers, straps for which are already provided. The levers can either be supported with struts if used on the side the weight is suspended, or they can be secured to the other road, if used on the opposite side, due precautions being taken to block the line so used.

521. Cranes, except when actually engaged in lifting operations are not to be moved until the jib has been placed in line with the truck, and the jib must be lowered unless secured by the cams or other permanent gear so that it cannot get adrift.

522. The jib, when travelling, must whenever practicable point towards the rear of the train. Except in urgent cases, a crane must not be allowed to pass a turntable station with the jib pointing in the direction the train is running.

523. Cranes must be inspected every six months, when their maximum lifting power must be tested and all necessary repairs executed. The chains must ordinarily be annealed every two years; those in use on Relief train cranes must be annealed once a year.

524. All cranes must have their lifting capacity, and the size of the chain to be used, conspicuously painted on them.

525. Special care must be taken that the crane in working does not foul any adjoining track or that if fouling is unavoidable that this track is adequately protected by flags in the prescribed manner:—

(*a*) Cranes must be properly secured when work is finished.

CHAPTER XXVIII.

OIL INSTALLATIONS.

526. Generally speaking sites for oil installations should fulfil the following conditions : —

(1) They should be as far away from goods sheds and stations as possible.

(2) They should be so fixed as to be conveniently served by a siding from which the oil wagons can be unloaded and by a road which can be used for removing the oil.

(3) They should be so fixed as not to interfere with any future extensions of the station.

(4) They should be sufficiently far apart from each other, or be so protected, as to remove all possibility of danger should one installation take fire.

527. As regards condition (2) the installation may be fixed near some traffic dead end, the use of which for stabling the oil wagons while being unloaded will not interfere with the general working of the station. If such a siding cannot be found even though one exists already serving existing oil installations, the provision of a special siding will be necessary.

528. In all cases however it might be noted that it is not essential for an Installation to be quite close to the sidings as they can be served by a pipe line, provided the point of discharge from the wagon is not more than 600 feet away from the Storage Tank.

529. Lessees of Bulk Oil Depôts must pay the cost of making approach roads to their installations if such do not already exist and must also pay rent for the land occupied by the said road.

530. There are definite distances prescribed in the "Rules for the Storage of Petroleum and Dangerous Spirits" within which no building must be erected adjoining an Oil Installation. These rules must be rigidly adhered to.

531. The area of land which is leased for the purpose of the Oil Installations and on which rent is to be paid is the area within the prescribed limits and not merely the area contained by the enclosure wall of the Oil Depôt.

CHAPTER XXIX.

GRASS AND FRUIT IN STATION COMPOUNDS.

Grass and fruit in station compounds.

The following are the rules in regard to grass and fruit in Station Compounds :—

532. A station compound is defined to be a maximum distance of 500 yards on each side of the centre line of the station. The area within which grazing will be allowed is, in the case of stations, the wide portion of the station yard only ; and, in the case of block huts, a distance of two telegraph poles from the centre of the block hut.

533. At all stations except those enumerated in the next para. the Railway Staff are allowed to graze their cattle, *provided they are securely tethered,* within any part of the station compound, no animal when at the end of its tether to be within 12 feet of the rails.

534. No cattle are permitted to be grazed within the station compound at the following stations :—

Howrah,
Burdwan.
Ondal.
Raneegunge.
Asansol.
Sitarampur.
Dhanbad.
Kusunda.
Madhupur.
Jhajha.
Rampore Haut.
Sahebgunge.
Jamalpur.
Luckeeserai.
Mokameh.
Gya.
Patna.
Bankipore.
Dinapore.
Buxar.
Moghal Sarai.
Mirzapur.
Allahabad.
Cawnpore.
Tundla
Shajahanpur.
Bareilly.
Moradabad.
Lhaksar.
Dehra Dun.

535. The Railway staff who have cows may receive a grazing pass for a certain number of cattle in charge of a "*Gowallah,*" who will hold the pass as his authority, and this pass must be shown on demand to the contractor who has purchased the right to cut grass or to the employés of the Engineering Department in charge of the Railway property at that Station. The Grass-Contractor and the Superintendent, Way and Works, should be advised of the number of cattle allowed to graze at each station and also of any alterations which may be made from time to time in the number, and on the back of such pass the number of cattle should be shewn in bold vernacular figures. If in any case there are three cows belonging to the station staff the pass should be given for four, so as to allow a margin for fresh acquisitions and births, but the number of cattle for which grazing passes will be issued will be left to the discretion of the Divisional Superintendent.

536. Grazing passes will be issued by the Divisional Superintendent only, who may, if he considers it desirable, allot such less distance than that mentioned above, as he may consider sufficient to give grazing ground for the use of the persons mentioned. These passes should clearly indicate that they entitle the holders to grazing rights only, and not to the right of cutting grass or of preventing the Grass-Contractor from cutting grass.

537. No cattle are allowed be graze outside station limits and the owners of such cattle found trespassing may be prosecuted.

538. The cutting of grass by Railway servants except when ordered to do so by an Engineer is strictly prohibited.

539. When the grass, or any portion of it, in the Railway boundary is let to a Contractor, a clause should be inserted in the agreement with him to the effect that, in the event of a servant of the Administration being detected removing such grass, redress must be sought, not through the Police—making over the case to whom will render the contract void—but through the Divisional Superintendent or Engineer-in-charge.

540. The charge of all trees and shrubs within Railway boundary is in the hands of the Divisional Superintendent, and all fruit and other produce of such trees and shrubs will be dealt with as the Divisional Superintendent, or Engineer-in-charge may direct.

CHAPTER XXX.

Rules for testing eyesight.

The following Rules are given in Agent's Circular No. 451 of 13th January 1926.

541. No one shall be employed on duties connected with the working of trains and signals until he has been examined for colour and night blindness and pronounced to possess normal colour vision, to be free from night blindness and to be fully competent as regards eyesight for the efficient performance of his duties. The tests and re-tests of eyesight shall be conducted in accordance with the following rules:—

I.—Examining Officers.

(*a*) All District Medical Officers.

(*b*) Assistant Surgeons when doing the work of District Medical Officers.

II.—Classification of Employment.

For the purpose of visual requirements the staff should be divided into 3 classes.

CLASS A.

Staff employed in duties actively connected with the movements of trains and the recognition of signals; these to be further divided into two grades.

Grade I—To include employees requiring the highest visual capacity, *viz.*:—

Drivers (including Motor Trolly Drivers), Firemen and other foot plate staff.

Shunters.

Steamer commanders and others employed in navigating steamers.

Grade II.—To include employees requiring normal combined vision consistent with a refractive error, *viz*—

Transportation Inspectors { Commercial. Power. Movement.

Signal Inspectors.

Guards.
Gunner Guards.
Assistant Station Masters.
Brakesmen.
Pilot Guards.
Pointsmen.
Switchmen.
First class Gatemen.
Cabin and Signalmen and *all Shunting staff.*
Station Masters.
Yard Foremen.
Yard Masters.
Assistant Yard Masters.
Platform Assistants.
All Engineering staff on permanent way, with the exception of those noted in VII.

CLASS B.

To include employees whose duties are not intimately connected with the working of trains but which call for ability to observe correctly the movement of trains and signals such as—

Transportation Inspectors (Stock).
Running Shed Foremen.
Assistant Shed Foremen.
Drivers in Charge.
Fitters in Charge.
Depôt Store Keepers.
Electricians.
Inspectors of Works.
Assistant Inspectors of Works.
Motor Lorry Drivers.
Train Examiners and Assistant Train Examiners.
Trains Clerks.
Number Takers.
Lampmen.
Slip and Flood Watchmen.

and other staff who, by reason of their occupation, should, in the opinion of their Departmental Officers, be sent for visual examination to the Medical Officer.

CLASS C.

To include employees whose duties are entirely unconnected with the movement of trains and whose visual capacity is such as in the opinion of the Railway Medical Examiner is sufficient for the efficient performance of their duties.

III.—Requirements on first Appointment.

When it is proposed to engage a man, the class of post in which he will be first employed will be intimated to the Medical Officer on Form G. 101. After examining him in accordance with paras. IV-A or IV-B, the Medical Officer will certify whether his eyesight is sufficiently good for him to be employed in the class intimated.

IV.—Tests on first Appointment or promotion to posts of each class.

A. *For Class A Posts.*—A clear certificate will be required under the following conditions:—

(*a*) Spectacles for distant vision are not allowed.

(*b*) Strabismus (squint) or any defective action of the exterior muscles of the eyeball will disqualify a candidate

(*c*) To determine the visual acuity.

(*i*) Each eye shall be examined separately.

(*ii*) The Army dot test will be used.

(*d*) To determine the colour sense, a candidate must pass the following tests.—

(*i*) Holmgren's wool test.

(*ii*) William's lamp test at a distance of 20 feet in a dark room or at night.

B. *For Class B. Posts*:—

(*a*) Spectacles are allowed up to a total of 3·5 D. for myopia and myopic astigmatism and 4·0 D. for hypermetropia and hypermetropic astigmatism.

(*b*) Eyes to be examined separately and a greater error than this in either eye to disqualify.

(*c*) As in para. IV-A (*d*).

V.—Re-tests for retention in posts of each class.

Re-examination of employees in classes A and B.

The eyesight of all employees in class A (i), and (ii) and in class B shall be re-tested as follows:—

(*a*) Every third year up to the age of 45 years and thereafter annually, or at such shorter intervals as may be considered necessary by competent authority.

(*b*) Before resumption of duty after meeting with an accident or after any illness liable to affect the eyes.

(*c*) Within one week after any neglect of signals whether resulting in an accident or otherwise.

The eyesight of all employees in class C shall be re-tested after any illness affecting the eye and as required by competent authority.

Spectacles for correction of distant vision shall not be allowed for employees in class A Grades (i), and (ii), before the age of 45 years, after which age spectacles may be worn if recommended by the Examining Medical Officer, provided that an Employee who has been authorised by a Medical Officer to wear glasses before the publication of these rules may continue to do so, but must be re-examined annually.

Cases in which on examination or on re-examination the authorised examining officer is of opinion that the standard reached by the candidate is sufficient for the particular work on which he is engaged when this does not come up to the standard laid down, may be referred to the Chief Medical Officer.

An employee who is permitted to wear spectacles by the Examining Medical Officer will be required to provide himself with two pairs of such spectacles and to always wear spectacles while on duty.

Note.—When an employee is sent for a re-test in eyesight, the Medical Officer must always be informed on Form G. 101 the class in which the employee is working.

VI.—Record of tests and re-tests.

A careful record should be kept of the results of all tests and re-tests and the original Medical Officer's reports of these shall be filed so as to be available when necessary.

VII.—Permanent-way Gangmen, Gate-keepers, Trolly and Signalmen.

In view of the difficulties experienced in examining Permanent-way Gangmen, Gate-keepers, Trolly and Signalmen according to the above detailed tests such employees, exclusive of mistries and mates should be put through the following tests by a responsible railway subordinate. These tests apply to initial as well as periodical examinations :—

(*i*) Ability to distinguish a standard test lamp at 50 yards distance on a clear night, and to state whether the colour is red, green, or white.

(*ii*) Ability to distinguish and name a red, green, or white signal flag at 300 yards distance on a clear day.

(*iii*) Ability to distinguish the position of a Model Signal Arm one foot long and 2 inches deep at a distance of 300 yards during the day.

Any Permanent-way Gangman, Gate-keeper, Trolly or Signalman who fails to pass such tests successfully should then be referred to the Medical Officer for a test as laid down in these rules.

• CHAPTER XXXI.

TRESPASSERS.

542. All trespassers should be warned off and, if the practice is persisted in, handed over to the Police if practicable.

Disposal of Trespassers and Railway servant when run over.

543. When a person is run over between stations and life is clearly extinct, the body should not be moved more than is necessary to clear the line, until after arrival of the Police, but should be left in charge of a Lineman, Gateman, or village Chowkidar, if available. If there is no one available it may be removed to the nearest gate-lodge; but in either case the following particulars should be noted:—

Position of body on line.

Blood stains on ballast or engine, extent of injuries and whether seemingly inflicted by a train or otherwise.

Position of any clothing, &c., found on or near the rails.

These particulars should be made over to the man placed in charge of the body, to be given to the Police Officer when he arrives.

If life is not extinct, the person should be taken to the nearest station where medical aid can be arranged for.

CHAPTER XXXII.

CHIEF ENGINEER'S ANNUAL INSPECTION.

544. The following instructions are to be observed with a view to facilitate the disposal of business:—

> All Engineers and Engineering Inspectors should join the Inspection Special at the commencement of their charges and leave the train at the end of them, and Engineers should travel in the Inspection carriage and Inspectors in the 2nd class carriage or brake van.

545. Engineers must report to Chief Engineer before leaving the train and Inspectors to their Superintendent, Way and Works.

546. Sleeping accommodation is provided for all officers (below the rank of Deputy or Divisional Superintendent is provided in a 1st class bogie carriage), and they need not make any arrangement for meals as a Restaurant Car will travel with train throughout the Inspection, and provide all meals at a charge of Rs. 5 per diem, *viz.*, Chota Hazri, Breakfast, Lunch, Tea and Dinner.

547. For each day's work the Senior Superintendent, Way and Works, should ascertain on the evening of the day before that all arrangements have been properly made and that the Operating Staff fully understand the details of the programme to be worked to, so that there may be no unnecessary delay in regard to crossing or passing trains or due to goods trains having been allowed to occupy the line when the Inspection Train is due. The Senior Superintendent, Way and Works, should also ascertain the evening before that all arrangements have been made for a punctual start next morning, so that there may be no delay owing to carriages having to be attached or watered or other operations having to be undertaken just when the train should be ready to start.

548. On each Division the Senior Superintendent, Way and Works is to have with him the following drawings and papers:—

Index plan and section.

Ferro Plans of all important stations.

General Ferro prints of principal works in progress.

Diagramatic report of works in progress.

Bridge Register.

Flood Register.

Permanent Way Register.

And any other ferro drawings or papers likely to be wanted. These drawings and papers to be arranged and marked in a suitable manner for ready reference. It would generally be convenient to have an intelligent draughtsman in charge of these papers. He can sit in the Drawing Office of the Inspection Carriage and be ready to produce papers as required.

Note.—Tracings are not to be taken on the Inspection Special

549. At the commencement of each day's work the Senior Superintendent, Way and Works or District Engineer should show the Chief Engineer the report of works in progress on the length to be traversed during that day, and settle then what works are to be inspected, and at what places the train is to be stopped for this purpose. The Engineer concerned should himself go over the report carefully beforehand and mark those works which he intends to select for inspection.

550. At the commencement of each fresh length of a Permanent Way Inspector, the Superintendent, Way and Works, is to bring forward the Bridge Register, Flood Register and Permanent Way Register for that length.

551—555. All notes regarding Engineering matters in his charge and orders of Chief Engineer, will be made by the Senior Superintendent, Way and Works or District Engineer concerned. Immediately after the Inspection of his charge he is to write out the Inspection Report for his charge on the basis of these notes and send this report to the Chief Engineer's Office at Calcutta for such action as may be necessary. This report is not to be a mere copy of the notes, but is to be written out fully and completely in the usual style for such documents. It should, if practicable, be written out day by day during the inspection while the facts and details are fresh in the writer's memory. Although actually written by the Senior Superintendent, Way and Works, or District Engineer, the document will nominally be the Chief Engineer's report and should be worded accordingly.

CHAPTER XXXIII.

SANITATION AND MEDICAL.

Compounds of bungalows and stations.

556. The Officers of the Engineering Department are instructed to remove any cattle found in station compounds untethered and impound them and the owners can also be prosecuted.

557. Cattle are to be kept in the compounds of Railway bungalows only when tethered. For each case of infringement of this rule a fine not to exceed Re. 1 is to be inflicted by the Division Officer on the occupant of the bungalow, and the occupant is also to be charged with the cost of any damage to Railway property or to the property of his neighbours from cattle being at large. The rule is to be equally enforced whether the compound in question is fenced or unfenced.

558. Animals other than cattle may be kept in Railway bungalows or compounds only subject to such rules as may be made by properly authorized persons in regard to each station. Such rules may prohibit animals being kept of a kind or number such as to be a source of annoyance to others than the owner, or such as might lead to insanitary conditions. The rules need not be the same in every station and in many cases the necessity for making them may not arise.

559. The person authorized to make the rules referred to is the Divisional Superintendent.

560. Where a Sanitary Committee exists it will be one of their duties to bring to the notice of the Divisional Superintendent where such rules are considered necessary. At any station any individual resident may apply to his superior officer for rules to be put in force

561. The Agent authorizes the Superintendent, Way and Works, or the Assistant Engineer in charge of such compounds or quarters, after having given reasonable notice to the person or persons in occupation, to take action in respect of any compounds or quarters which may be neglected and dirty and have the same cleaned by the staff of his department, reporting the cost to the Divisional Superintendent with the name of the occupants responsible for the neglect.

562. Such cost will then be recovered from the occupants by demand, or, failing this, by deduction from pay bills on the first opportunity.

Disinfecting Wells.

563. Quick lime, alum and permanganate of potassium have been decided upon as the least expensive and most effective disinfectants that can be used for the purpose.

The agents selected are perfectly harmless to men and animals when used in the prescribed manner and quantities.

564. When lime is chosen it ought to be perfectly fresh; the freshness being tested by putting a certain quantity of the lime into a little water. If the water boils the lime is good. As to the quantity required the proportion given is two parts in a thousand, and may be found thus:—"Multiply the diameter of the well in feet by itself and by the depth of water. Divide the product by 10. The result gives the number of pounds of lime that have to be added to give a proportion of two parts in a thousand." For an hour and half after the lime has been added, the water should be well agitated to ensure a thorough mixing; this, it is suggested, can be done by the Persian-wheel or with a rope and bucket; in either case the water being poured back into the well and care being taken to thoroughly wash the inner surface of the well with the mixture of lime and water. The process is to be repeated in a day or two; and when the water has cleared, it may be safely used. If alum is used, it ought to be finely powdered and then added to the water. The process is the same as in the case of lime. The quantity of alum required is to be calculated at the rate of 125 grains to each cubic foot of water in the well. The square of the diameter of the well multiplied by ¾ and by the depth will give the number of cubic feet. The process to be employed in disinfection by the use of permanganate of potassium is as simple and as cheap as that for the other two. Potassium Permanganate should be added in solution and not in solid form. Sufficient of the salt should be added to give the water a faint pink colour; for ordinary wells from one to three ounces is considered enough. "The salt should be added in the evening," directs Mr. Hankin, "so that the water may be left undisturbed as long as possible; in from 24 to 48 hours the colour will have disappeared from the water, and the well will then be fit for use."

Treatment of Diarrhœa and Cholera.

565. Avoid all strong purgatives when cholera is known to be about, also food which is apt to set up diarrhœa, such as bad fish, over-ripe fruit, cucumber, tinned food and impure drinking water, *also water from mussuks should not be drunk.* It is strongly advised that during an epidemic of cholera all milk and drinking water should invariably be boiled for at least ten minutes. After water and milk have been boiled they are to be kept in clean *covered* vessels.

566. Meat and food are to be covered to keep off flies, which frequently convey the cholera germ.

567. During an epidemic of cholera every case of diarrhœa should be treated as though it were the diarrhœa of the early stage of cholera until medical assistance is procurable.

568. When an adult is attacked with severe diarrhœa or cholera, 25 or 30 drops of chlorodine should be given at once.

569. One further dose *and no more*, of 25 drops may be given one hour later.

570 If the patient be a child, the dose should not exceed 0-1 year 1 drop, 1-2 years 2 drops, 3 to 5 years 5 drops, 5 to 8 years 7 drops, 8-12 years 10 drops.

571. Should the patient be collapsed, or in state of great prostration, no chlorodine should be given.

572. The Cholera pills and drops made at the Allahabad Medical Depôt are excellent and should be used as follows.—

573 Two of the *cholera pills* should be taken with an interval of half an hour between each.

574. A quarter of an hour after the second pill has been taken the Cholera drops should be given. The dose is ten drops in a table-spoonful of water, and it should be taken 'every quarter of an hour.' Whilst the drops are being given bottles containing hot water or hot bricks should be placed in the armpits.

575. *To relieve vomitting and thirst*, a large mustard plaster should be applied over the pit of the stomach and kept on 30 minutes. Small pieces of ice, and doses of a table-spoonful of water, which has been boiled, or soda water, should be given often. The patient should be kept strictly on his back, and very quiet.

576. *Cramp should be treated* by hand rubbing either with ginger powder, or a little turpentine.

577. *For retention or stoppage of urine* encourage the patient to drink plenty of cold or barley water, and apply a mustard plaster over the loins. This is only to be done when the patient has passed out of the stage of collapse.

578. The diet should consist of thin soup, arrowroot and milk, in small quantities, and even these should not be given until the patient has recovered from the stage of collapse.

Conservancy rules as under must be strictly enforced:—

579. The vomit and motions from cholera patients should be disinfected, *with the least possible delay,* with from one or two pints of a 1 in 1,000 solution of Bichloride of Mercury, which is to be poured over the vomit and motions which should then be buried at once in a trench of earth 4 feet deep far away from any well or river *and not thrown on the dust heap.*

580. All clothes, towels, sheets or other fabrics soiled by the vomit or motion also the straw in cholera huts should be promptly burnt. If the patient has only one set of clothes they should be disinfected in the above solution and then boiled for half-an-hour. Mattresses should be burnt. *Dhoolies* should be washed thoroughly in the Bichloride solution and kept in the sun for 24 hours.

581. When cholera appears among a gang of coolies or pilgrims at stations they should *not be allowed to encamp on the platform or in the Railway goods shed,* but should be sent at least 200 yards from the Station, and their camping ground changed daily. No *lotahs* from beside cholera patients should be dipped into wells. A high caste man should be put in charge of the well and made to draw the water for all the camp with a clean *dole.*

582. If a case of cholera be found in a train, the patient, whether employé or passenger, should be removed either to the camp, contagious diseases hospital, or cholera hut, or he should be placed in the shade, right away from the Railway station and the station well. During an epedemic of Cholera all wells should be disinfected at least once a week with Permanganate of Potash.

583. Cholera drops and pills are supplied to every Station Master throughout the line.

584. All latrines, after an epidemic of cholera, are to be scoured with boiling water, and lime washed, brick latrines are to be tarred.

585. Foremen, Station Masters and Inspectors are to report by wire to the District Medical Officer any case of cholera occurring at their stations.

Instructions as to disposal of bodies in cases of death from cholera.

586. If a Hindu, the body should be completely burnt in an isolated place at least half a mile away from the station.

587. If a Muhammedan, the body should be burried at least 6 feet deep and covered with quicklime. The place of burial should be well away from habitations and sources of water supply.

588. Of the various schemes that have been put into operation for the eradication of Plague, the most sucessful appears to be that which has for its object the extermination of rats, and the introduction of this process at the Railway Collieries at Giridih having been attended with the most gratifying results, it may be extended elsewhere at station where Plague is prevalent. Precautions against Plague.

589. The following is a summary of the measures adopted at Giridih and are those which should be adopted as far as local conditions allow :—

i. The rats are brought in the cages in which they are cought twice a day morning and evening.

ii. The cages containing the rats are then completely immersed in water and perchloride of mercury kept in a wooden cask. This drowns the rats and disinfects the cages. This operation is done near a large fire—a boiler furnace for preference, one being always at hand on the Collieries.

iii. Rough wooden boxes are provided of sufficient size to contain up to 24 rats One of these boxes is placed on a shovel in front of fire. A little jute is placed in the box, for the fleas to nestle on. as it has been found that the fleas are more difficult to drown than the rats are, and they leave the cold body of the drowned rat, and to prevent them hopping on to the persons handling the cages, jute is placed there to attract them.

iv The cages are then taken out of the Perchloride solution. The door at one end of the cage is opened, and the rats dropped into the wooden box and with as little delay as possible the box containing the dead rats and fleas is thrown into the fire.

v The cage is then baited and handed over to be used again.

vi. Handling of the rats is strictly prohibited.

590. The main precaution to be observed is to ensure that both rats and their fleas shall be promptly destroyed on their submersion in the Percloride of Mercury bath, the strength of which should be 5 drachms in 2 gallons of water. No acid should be used, as it would corrode the rat traps.

The Controller of Stores will supply the necessary rat traps.

APPENDIX A.

Table of weights for calculating freight of various classes of materials by Ballast train.

100 C. ft.	Ashes	78	maunds.
1,000 Nos	Bricks	93	„
100 C. ft.	Brick ballast	75	„
100 C. ft.	Brick bats	74	„
100 C. ft.	Cement	110	„
100 C. ft.	Coal, dust	67½	„
100 C. ft.	Coal, steam	68	„
100 C. ft.	Laterite	70	„
100 C. ft.	Lime Sutna (slaked)	57	„
100 C. ft.	Sand (dry)	115	„
100 C. ft.	Soorkhee	83	„
100 C. ft.	Stone ballast (trap)	100	„

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